UPPER THAMES VALLEY CONSERVATION REPORT 1952

SUMMARY

DEPARTMENT OF PLANNING AND DEVELOPMENT


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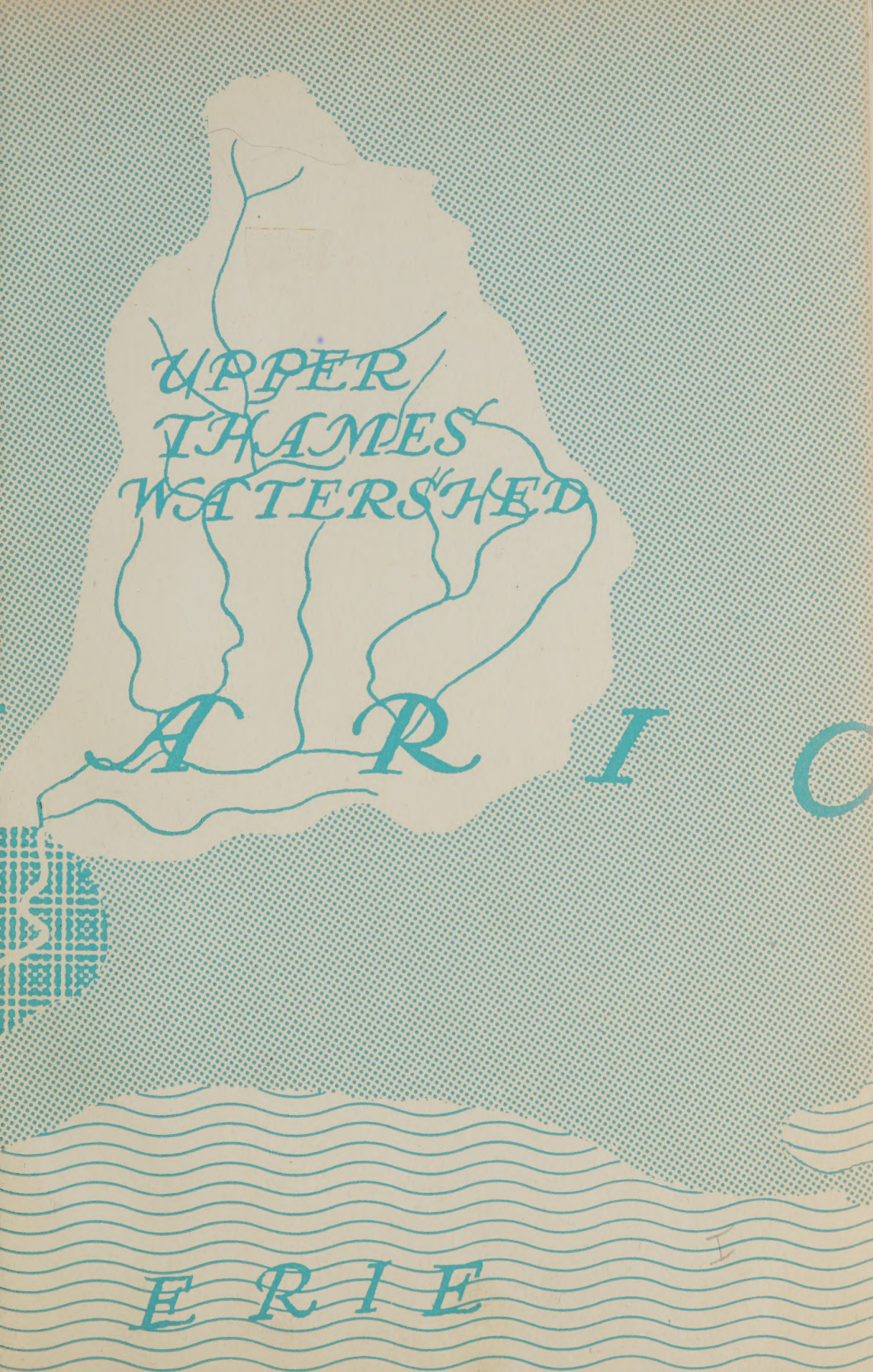
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—By Keith Reynolds for Planning and Development

UPPER THAMES RIVER

Department of Planning and Development

HON. WILLIAM GRIESINGER, Minister

A. H. RICHARDSON
Chief Conservation Engineer

UPPER THAMES VALLEY CONSERVATION REPORT 1952

SUMMARY

TORONTO
Printed and Published by Baptist Johnston, Printer to the Queen's Most Excellent Majesty
1952

Upper Thames River Conservation Authority

Established September 18, 1947

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INTRODUCTION*

During the spring of 1945 representation was made by a conservation committee of the Upper Thames Watershed to the Honourable Dana Porter, Minister of the Department of Planning and Development, to undertake a conservation survey of that part of the Thames Valley, with special reference to flood control. This request was the culmination of much effort over the preceding years by the citizens of this area, chiefly in the urban centres, who had become alarmed at the tremendous damage which had been done from time to time by excessive run-off in the Thames Valley. This committee realized, however, that the protection of the urban centres from flooding was not the only problem to be considered, but that land use over the whole watershed should be studied and that recommendations should be made for its correction where such was needed.

At that time The Conservation Authorities Act had not been passed, but so urgent was the need for a solution of flooding on the Thames that the newly formed Conservation Branch of the Department of Planning and Development undertook the survey as its initial effort. But in doing so it was clearly pointed out that flood control, while important, would not be the only problem investigated, but also the complementary problems of land use, forestry, wildlife and recreation.

The Second World War was still in progress in 1945; qualified personnel for surveys was limited. Consequently it was necessary to secure the co-operation of science teachers from the collegiates of the Province and due to the limited training of these men in soils and forestry the amount of detail which could be covered was also limited. In the work of hydraulics, however, sufficient competent help was obtained so that the problem of flood control was covered more thoroughly. Land use studies, forestry and stream conditions were confined to a small part of the watershed and covered only the watersheds of the Cold Creek and North Branch Creek. But while it was realized that this coverage was inadequate, it was all that could be done under the circumstances, and the results of these studies as presented in the report were considered only as a token survey to indicate what the conditions in these three fields were over the whole area. However, these token surveys, together with the work in hydraulics, indicated to the people of the Upper Thames how the whole pattern of conservation is inseparably related.

The report which was based on the 1945 survey was presented to the Upper Thames Committee at London in October, 1946, by the Honourable Dana Porter, Minister of Planning and Development at that time. The enthusiasm with which this report was received and the action taken on its recommendations cannot be enlarged upon here. Nevertheless it should be stated that the Upper Thames Authority now is the most active group of its kind in the Province. Besides many activities in general conservation, the construction of the Ingersoll Channel and the commencement of the Fanshawe Dam, as well as the reforestation agreement with the Government, all stem from recommendations contained in the 1946 report.

*From the full report.

After the war, and when students from the different science faculties of the universities were available, the whole technique of land use, forestry, and wildlife surveys was changed and improved and this changed procedure has been followed in surveys conducted by the Conservation Branch since that time.

In the spring of 1950 the Upper Thames River Conservation Authority requested the Honourable William Griesinger, Minister of Planning and Development, to re-survey the Upper Thames Watershed in accordance with the improved methods adopted by the Conservation Branch and that this information be set down in report form comparable to the reports being prepared for other Authorities. This survey was carried out in the summer of 1950 and the results are embodied in the present report.

Certain sections of the old report—chiefly history, land settlement, recreation and the history of floods—have been repeated in the 1951 edition. These, however, have been revised and brought up to date where necessary. The sections on land use, forestry, stream conditions and, to a certain extent, hydraulics are for the most part new material.

Lastly, the 1946 Thames Report was typewritten, which limited its edition to only eight copies, whereas 200 copies of the present report have been mimeographed. In addition, 3,000 copies of a summary with selected maps and many illustrations will be printed. The full report is intended as a working plan, chiefly for the guidance of the members of the Authority and other officials, while the summary is an abridgement of this for general distribution throughout the watershed.

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I

HISTORY

CHAPTER 1

THE AREA BEFORE SETTLEMENT

The section of the Thames Watershed dealt with in this report lies above the confluence of the river and Dingman Creek. This tributary joins the Thames from the east near the village of Delaware, about ten miles south-west of the city of London. The selection of this point of division is not entirely arbitrary, for the watershed above Delaware differs considerably from the section between Delaware and Lake St. Clair. The watershed is here widened on either side by the drainage areas of tributaries of some size, even before the river itself divides at London into two main branches flowing nearly at right angles to one another. The branches are themselves joined by numerous tributary streams, so that the Upper Thames Watershed

forms a large and compact area in contrast to the narrow and long area of the lower valley. The character of the river also alters, a little below Delaware, and above the village the topography of the watershed begins to change, while above London this difference is still more marked.

This Upper Thames Watershed lies in the interior of the great peninsula of Western Ontario, roughly forty miles to the westward of Lake Ontario and about the same distance east of Lake Huron. It includes the cities of London, Woodstock and Stratford; the towns of Ingersoll, St. Marys and Mitchell; and the incorporated villages of Tavistock and Embro. It contains a great part of the Counties of Oxford and Perth, a smaller proportion of the County of Middlesex and some small areas in the County of Huron. Eight townships lie entirely within the watershed and parts of sixteen others are also included in it. It is with the settlement and development of these municipalities—townships, towns and villages—that this part of the report is concerned.

The separation of the Thames Valley into an upper and a lower section is not inconvenient as far as the history of settlement is concerned. The stretch of undeveloped woodland known as "the Longwoods" for many years partly cut off the settlements on the Lower Thames from those in Middlesex and Oxford Counties and to a great extent the two areas were independent of one another. Until the white man finally established himself on the river, however, this separation had little meaning. The whole area between Lake Ontario and Lake St. Clair formed one region and when the first French explorers arrived it was controlled by one Indian nation. Some traces perhaps exist of earlier and different inhabitants, but so little is as yet known of these prehistoric Indians that an account of the area may well begin with the "Neutrals".

The territory of the Neutrals lay on both sides of Lake Erie and on the north shore extended well into the Thames Watershed. Their principal villages lay outside the area to the east, south and south-west, but the river with its easily cultivated flats must have played a fairly important part in their economy. Father Joseph de la Roche Daillon, a Recollet missionary, visited the eastern part of the Neutral territory in 1626-7. He estimated that they numbered about 12,000 souls.

Though at peace with the Iroquois and Hurons, the Neutrals had a fierce and unceasing feud with the Fire Indians to the west. When the Iroquois destroyed the Hurons, they turned on the Neutrals who were caught between two fires. By 1651 they had been driven from their territories and had ceased to exist as a separate nation.

Though few sites near the Thames can be definitely identified as Neutral villages, it seems very probable that they used the "Indian Corn Fields" on the North Branch west of the Forks, and the extensive flats near Delaware. Their chief legacy is probably the network of trails crossing the area, for an Indian path once established was rarely departed from to any extent. These trails would be used in succession by the Iroquois, Chippewas and the fur traders, and finally by the first settlers. The earliest roads often followed them for at least part of their course and, though the later high roads struck straight across country to conform to the surveys, their importance and frequently their direction was due to the former existence of an Indian path.

Lieutenant-Governor Simcoe had decided, while still in England and soon after his appointment as Lieutenant-Governor of Upper Canada, that the capital of the new province should be located "at the head of navigation of the River La Tranche". On February 10, 1793, he set out from the Mohawk village on the Grand River by the Indian path to Detroit, with the purpose of exploring this little known area.

The party travelled on foot with Indian guides, some of whom went ahead to light fires and build huts for the night. There were no houses of white men between Daniel Springer's trading post, a few miles west of the Grand, and another trader's some distance beyond the Upper Delaware Village. The trip from the Mohawk Village (Brantford) to the ford of the Thames near Delaware took four and a half days of walking.

On the return journey they made a detour upstream, mostly on the ice, and spent a day examining the vicinity of the Middle or Main Forks. The possibility of making "an excellent shelter . . . for Batteaux &c." in the Cove was noted, the amount of flooding on the flats was estimated and the possible town sites examined. One of the latter, "on a fine, dry plain without underwood, but abounding in good oak trees", was selected "for the capital of the country, to be called New London".

The Lieutenant-Governor was delighted with the country through which he had passed and more determined than before that the capital should be at London. Settlers were already seeking lands in the area, but the title of the Indians had first to be extinguished by purchase. Oxford, Dorchester, Westminster, Delaware and London Townships were purchased in 1792-3; the rest of the watershed in 1822 and 1826.

CHAPTER 2

THE PIONEERS

1. SETTLEMENT—1794-1812

(a) ASSOCIATED COMPANIES—DELAWARE, NORTH DORCHESTER AND OXFORD TOWNSHIPS

When Lieutenant-Governor Simcoe made his first journey down the Upper Thames in February and March, 1793, no grants in the area had been made to settlers. Simcoe was hardly returned to Niagara before he gave orders for opening the first road to the Thames and approved the first application for land on the river.

On March 23, 1793, Thomas Ingersoll of Great Barrington, Massachusetts, petitioned for the grant of a township for himself, the Reverend Gideon Bostwick and many other associates. They proposed to start a settlement with a large number of families who wished to move from the United States to Canada. The petition was granted without delay, chiefly on the strength of Mr. Bostwick's known loyalty and high character. Simcoe was eager to induce such Americans to come to Canada, believing that those who regretted the changes

were more numerous than was actually the case. He thought that they made the best colonists and that they would become loyal and dependable Canadians. He was frequently right, as in the case of the Ingersoll family, but he was also often taken in by unscrupulous landjobbers, whose only object was to exploit a new territory as far as possible.

The death of Ingersoll's associate may have delayed him in carrying out his plans. He and his settlers were in Oxford by 1795, but in the meantime settlement had begun in the south-west angle of the watershed. An application was made in May, 1794, for a similar reserve on the Township of Delaware by a group of associates who were already in the area. The petition of Ebenezer Allen, Aaron Allen, John MacDonald, Gideon Tiffany, Daniel Springer and others stated that they had already brought in ten families.

The number of settlers was soon increased. The Moravian Brothers at Fairfield noted on August 4, 1794: "White people . . . have begun a settlement forty or fifty miles up this river, thirty families strong, having lately come from Europe".

By 1799 the settlement had spread up river beyond Kilworth and must have contained between 200 and 300 people. Some of the settlers had been attracted by the "cleared flats", but it was the fine "Pinery" that was responsible for the quick growth of "Allen's Town".

In North Dorchester Township, a settlement similar to Allen's and Ingersoll's, but on a smaller scale, was begun in 1794-6, by William Reynolds and Samuel Satterlee.

This system of settlement under responsible leaders had been tried out in Lower Canada before the Revolutionary War. It had some advantages, since the presence of men of capital with a keen interest in the development of their township lightened some of the difficulties of frontier settlement. Where a genuine effort was made, as in Oxford and probably in North Dorchester, townships settled under this system got a better start than many of those open to ordinary grants but retarded by the curse of unimproved holdings. However, the system worked badly on the whole and in 1797 the British Government decided to rescind the reserves within a year, leaving decisions as to further grants (where the quota had been filled or nearly so) with the Acting Lieutenant-Governor in Council.

Thomas Ingersoll was hard hit by the removal of the reserves on Oxford Township and other settlers in Oxford were disappointed of their hopes. Some may have left their holdings, but Ingersoll remained for a time, still exerting himself to get new settlers and "persuading others to remain". The settlement was self-supporting before 1799, with more produce than it could consume. Ingersoll may have been keeping a trading post or store in 1799 in his house on the site of the town of Ingersoll and, since travellers regularly stayed there, he may also have owned an inn. He was soon appointed Justice of the Peace and Commissioner for taking the oath of allegiance required from new settlers. He probably hoped for a time that the British Government would modify the decision of the Provincial authorities with regard to additional grants. How-

ever, he was now beyond middle age, with a young family to educate, and he withdrew from Oxford to the neighbourhood of York in 1805, settling in the newly opened tract on the Credit River.

The growth in Dorchester was slower than in Oxford or Delaware. The settlers had turned to the exploitation of their Pinery. A sawmill had been built before 1799 on the creek running through William Reynolds' additional grant, close to the present village of Dorchester. There were an unusual number of Crown Reserve Lots along the river in Dorchester, some probably timber reserves. With the Clergy lots and the Reynolds grant these took up most of the river frontage. Some Reserves were leased before 1806, but the number of actual settlers was still very small.

(b) THE THAMES SETTLEMENT IN 1806

Charles Askins, travelling from Sandwich to York in June, 1806, has left a detailed account in his journal of the settlements through which he passed. Leaving the house above Muncey, where he had spent the night, he came in seven miles to the beginning of the Delaware Pinery and in about another mile to Allen's.

On the 2nd of July Askins left Allen's house "on the hill" with his host's half-breed son, Seneca, as guide. They passed the last settler's house about six or seven miles from Allen's and for the next eighteen miles, partly through the Township of London, they saw no settlement. By noon they were about fourteen miles from Allen's and halted to dine and bait their horses on "a small island in the river", close to the site chosen in 1794 by Governor Simcoe for the capital of Upper Canada. Twenty years later the city of London was laid out here, but it was several years after 1806 before any settler located in London Township.

After another eleven miles of uninhabited forest (in which, however, they met a traveller going to Detroit) they reached the Dorchester settlements. Here there were four houses and a very good sawmill. The Dorchester Pinery, however, struck Askins as poor in quality. The Oxford settlement extended for eight miles along the first concession with settlers on each side of the road, "even to the 2nd and 3rd concession". It contained a Methodist meeting-house, the first place of worship in use in the Upper Thames Watershed, a small tan-yard and some good houses.

(c) THE TALBOT TRACT

When Askins was at Muncey, he was told that he was twelve miles from Colonel Thomas Talbot's settlement in Dunwich Township. This had been begun in 1803 and had started a movement of settlers into the townships west of Long Point, until then almost unoccupied. Colonel Talbot had at first applied for the usual 1,200 acres, with 5,000 acres additional as a field officer, and a reserve on one township. He had been on Simcoe's staff in Upper Canada and later had served with distinction in Holland under the Duke of York. With the backing of Simcoe, Talbot was able to have the system of reserves on townships revived in his favour in an altered form. By the terms of his grant of

5,000 acres, he was to bring in settlers, surrendering to each 50 acres of his 5,000 and receiving in exchange a grant of 200 acres as his own property. This was to continue until the 5,000 acres were used up, when Talbot would be in possession of 15,000 acres of additional lands.

Colonel Talbot's reserve was afterwards extended to include some 28 townships. He was able to arrange that all settlers in this area should report to him for their locations, instead of to York. He issued location tickets, entering the settler's name on his plan of the township. In addition to his functions of Land Agent, Talbot was appointed Justice of the Peace and later Lieutenant of the County of Middlesex, an office that gave him command of the Militia. As he was in constant communication with the Governor and the authorities at York, he became practically a deputy-governor in the whole district from 1805 to 1812.

(d) SIMON ZELOTES WATSON—WESTMINSTER TOWNSHIP

The settlement of Westminster Township was due to the need for a better road near the river and a wagon road to the mouth of Kettle Creek. Simon Zelotes Watson undertook in 1810 to cut a road through the First Concession in return for a reserve from the Third Concession to the Thames. He was to settle this with British families from Lower Canada.

Watson had placed a number of settlers by the end of 1810 and another group was located independently near Lambeth, when the North Talbot Road was opened in 1811. Watson tried to extend his operations and change the terms of his contract by bringing settlers from the United States. A complicated dispute with the Government followed, involving a quarrel between Watson and Colonel Talbot. Watson's reserve was rescinded in 1812 and settlers allowed to locate in his reserve. He tried to keep these newcomers out by threats and later in the year joined Hull at Detroit. He was followed by a group of settlers from Westminster and Delaware, including Ebenezer Allen and Andrew Westbrook.

(e) THE THAMES SETTLEMENTS IN 1811-12

A description of the Thames settlements just at the time that war broke out with the United States is found in a book published in 1814 by Michael Smith, a schoolmaster at Niagara, but unfortunately it is doubtful how far the details of this account can be trusted.

Smith records the mills in Oxford which Askins had not visited and adds a fulling mill, a second tannery and two distilleries. He mentions a gaol and courthouse, two physicians, a Baptist minister and two congregations of Methodists served by circuit-riders. These developments are rather surprising in so small a settlement and even more so is Smith's list of carpenters, masons, blacksmiths, shoemakers, hatters and tailors. These "mechanics" would have sufficed to form a considerable village if all living in one locality, but if so many craftsmen were to be found in Oxford in 1812 they probably lived scattered on their own holdings, for every man was then a farmer whatever trade he might practise as well.

Horsemen fording the Thames at Moraviantown. From a sketch by Lt. P. Bambridge, 1838. The artist was standing near the site of the old village. The first villages must have been much like this one.

"A bush road in Upper Canada." From a sketch by Lt. P. Bambridge, 1842.

2. THE WAR OF 1812-14

(a) HULL'S INVASION

General Hull's invasion of the Western District from Detroit brought the war to the Thames settlements almost at once, though their first experience was brief and comparatively harmless. Hull's retreat and surrender to Brock postponed the "liberation" of the London District. The Oxford Militia had been called out and some were at the capture of Detroit and on the Niagara frontier in November.

(b) THE RENEGADES' RAIDS

It was now the turn of the British to invade enemy territory from Detroit, but the Battle of Put-in-Bay gave the Americans command of Lake Erie and forced Procter to withdraw. In October, 1813, he passed up the Thames in retreat from the defeat at Moraviantown, his troops doing a great deal of damage as they went through the settlements. The London District was now completely exposed, but as usual the Americans were unable to press their advantage at once. It was not till January, 1814, that Andrew Westbrook guided a raid on Delaware. The Americans now seemed to have little hope of permanent occupation and the raids became vindictive and destructive.

(c) McARTHUR'S RAID

The last raid up the Thames was the most destructive of all. It took place little more than a month before the treaty of peace was signed at Ghent on Christmas Eve, 1814. Nearly one thousand mounted Kentuckians and some Indians set out from Detroit on November 3, and had reached Moraviantown before the Canadians had any word of their approach. They claimed to be aiming at Burlington and moved quickly up the Thames, burning mills and some houses, killing or driving off stock, destroying hay, grain and flour and carrying off prisoners and much moveable property.

(d) POST WAR RECOVERY—1814-17

Peace was not proclaimed in America until well into 1815. When hostilities ended recovery was fairly rapid and was aided by a much needed inflow of cash. The British Government paid compensation, both for property damaged or destroyed by its own troops and for losses through enemy action. Arrears of militia pay and allowances were paid up and grants of lands were made to veterans. The requirements of the garrisons and Government works kept up the prices of lumber and farm produce. At the end of 1815 the price of flour had to be pegged at between $17 and $18 a barrel and hay at nearly $25 a ton. Once the farms on the Thames were back in production the farmers could share the advantage that the war had brought to more fortunate areas.

3. TRANSPORTATION

(a) NAVIGATION

The possibility of using the river for navigation was one of the chief reasons for Simcoe's plan to place the capital of Upper Canada on the Thames.

In January, 1793, he sent Augustus Jones to run a traverse of the river "from the (upper) Delaware Village up as high as it appears navigable for Batteaux in the Spring and Fall floods". Jones carried his traverse to a point near the confluence of Cedar Creek, then called the "upper Forks of the Thames." His report of the river from Muncey to London showed sufficient depth between rapids for boats of over 3-foot draught, but in the frequent rapids the depth was from 1½ to 2 feet. This would be ample water for scows if the channel were cleared, but during the next few years reports of other surveyors indicate that even in rainy weather it was often difficult to get a canoe through these rapids on account of the boulders, gravel banks and other obstructions, and in droughts the water in the shallows was often lower than 18 inches.

Travellers do not seem to have used the river to any extent, preferring the old Indian trail. Lumber and produce could, however, be rafted down from well above London in times of high water and this in itself was of great service to the settlers. The repeated statements that the Thames was navigable as high as London for batteaux and scows and to Woodstock for small boats and rafts must be accepted with reserve or with the addition of Jones's phrase "in the Spring and Fall floods". The upstream navigation to London was possible with much expense of time and trouble, but it was not the regular practice and the river could by no means take the place of wagon roads.

(b) ROADS

The first road was the Indian trail that crossed the river at the Muncey "Castle" and followed it to the neighbourhood of Dingman Creek and then struck north-east across Westminster past the Ponds, crossing the South Branch near the bridge on the later Hamilton Road. It returned to the south bank near the quarries at Beachville (Lot 19, Oxford North), crossed Cedar Creek near the fine grove of "cypress" or cedars that suggested the name, and made its way south-east through Burford to "Brant's Ford" on the Grand River. The first settlers in Oxford cut a wagon road "at the expense of Mr. Thomas Ingersoll" from Burford by "Canfield's" (near Oxford Centre) to "Haskin's" on the first concession of Oxford West, south of Beachville. From this point to Ingersoll's they saved labour and obtained a drier line by opening the road along the first concession line, where they were compelled to cut the road as part of their settlement duties. This road was most probably cut in the autumn and winter of 1796-7. The old "Detroit Path" along the north bank remained until after 1800.

About 1798-9 Elisha Putnam raised a subscription to carry on the road to Allen's settlement, but only succeeded in collecting enough money to cut a road passable for sleighs. Undaunted by this partial failure, he proceeded to raise a further subscription to continue to the Moravian Town and by September, 1799, had proceeded beyond Muncey.

Putnam's road struck south-west from near the Oxford-Dorchester Line to connect with the Indian trail in Westminster. By so doing it would miss most of the houses in the Dorchester settlement. Travellers however seem to have preferred to follow the river more closely. Most journeys at this time were

made on foot, either with packhorses or with packs. Wet weather increased the difficulties of travel, and even a foot passenger, if his pack was heavy, could make only 14 miles a day, as happened to Hambly, the surveyor, in April, 1800.

With good sleighing, travel was much faster and not unpleasant, but deep snow or sleet storms could slow down the winter rate and change a pleasant trip to purgatory for man and beast. There had been little change five years after Hambly's journey. In 1804 the Assembly voted £250 to improve the public highways in the London District and commissioners were appointed to report on the existing road and suggest improvements.

The Commissioners of 1804 recommended that the money be spent on a different route much closer to Lake Erie, and this "Talbot Road" was carried as far as Southwold by 1805. In 1807 the Commissioners were able to have the Talbot Road declared the Public Highway. This meant that Government funds would be expended on extending it, although the Thames road remained the travelled route.

The Talbot road was not carried on until 1811-12 when the "North Talbot Road" was laid out to connect it with Watson's road and with the Thames at Springbank. The North Talbot Road crossed the older road through Westminster at Lambeth and it was probably about this time that a trail was cut to connect this junction with the Forks. This also followed the line of an Indian trail. The Longwoods Road was improved in 1812-13 and was used by both sides for moving troops during the war. It was along the river road by Kilworth, Byron and Springbank that the Raiders reached Oxford. In 1814 the Assembly once more voted funds to repair Dundas Street right across the Province. This time the Commissioners were able to have the Thames road declared the Public Highway and "Commissioners' Road" was made along the South Branch on the left bank.

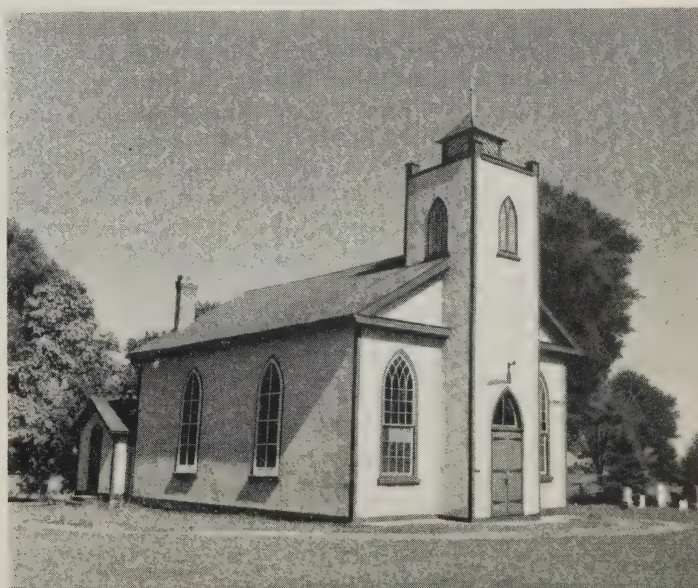
4. EARLY MILLS

The first settlers on the Thames were provided with mills within a few years of their arrival in the townships. Allens's Mills in Delaware were built in 1794 and the sawmill was in operation the following spring. The first direct reference found to grinding at these mills is in May, 1799. A grist mill in Oxford Township is referred to in September of that year. It was a short distance from Ingersoll's and in 1800 it is called "Burdick's Mill" and its position fixed on the creek running through Clergy Lot 16, Broken Front, Oxford West, in the field notes of William Hambly's traverse of the South Branch. Hambly's traverse of 1800 also places the "Dorchester Mills" on Lot 18, Broken A, a little back from the Thames. There was probably only a sawmill at Dorchester, for there are no references to grinding or buying flour.

There does not appear to have been a sawmill at Burdick's Mill in 1800, but one was built in Oxford Township within a few years. Charles Askins in 1806 says that "Arnold's mill in Dorchester" was ten miles beyond the Dorchester sawmill. Ten miles east along the road would carry a traveller over the Oxford Line and a little beyond "Putnam's" on Lot 27.

Remains of an undershot mill-wheel at Kilworth from a later mill near the site of Springer's sawmill of 1819. Such large wheels turned grist or woollen mills. The early sawmills used a smaller type.

North Mill, Embro. There was a grist mill at Embro by 1835. This one has been used since it was built about 1845. The earlier frame grist mills on the Thames were very similar.



Anglican Church at "Huntingford" (South Zorra). The earliest churches were frame buildings of this simple type. Few of those built in the 1840's were more elaborate.

A stranger might easily mistake a township boundary and it seems highly probable that Arnold had a sawmill near the present Ingersoll waterworks as early as 1801. Askins mentions three sawmills at Delaware—Brigham's, Allen's and Druillard's; the last, three miles from Allen's, probably up the river. This makes five sawmills at least in the area in 1806. A sixth had been built by 1812 in Oxford and it is possible that there were others in Delaware and Westminster before the war.

Grist mills were not an absolute necessity in a frontier settlement, but they were so great a convenience that every effort was made to secure one as soon as possible. A single mill could serve one or two townships at first and no more need be built until a good deal of land was under cultivation. In 1812 there were probably four grist mills in the Upper Thames area. There can be little doubt that most of these were burned in 1814, but three years later all four had been rebuilt and there was one in Delaware, one in Westminster and two in Oxford. Arnold's sawmill is not heard of again and it is probable that there were now sawmills in connection with both the Oxford grist mills and that the two distilleries mentioned by Michael Smith were also part of these establishments. Most millers and storekeepers had stills to convert the grain they took in trade to a more portable and saleable form. The only other industrial activity recorded is the two Oxford tanyards, but there must have been asheries as well. These were more often operated by merchants, for it was usual to pay for ashes in goods or whisky.

Carding and fulling mills, to relieve the housewife of the heavy labour of combing the wool and dressing the cloth, were to be found in most townships that had progressed beyond the first stage of development. They sometimes had their own dams and ponds but more often were established near an existing mill and drew their power from the same source. This was probably the case with the fulling mill in Oxford reported by Smith in 1812. It is not listed by Gourlay in 1817 and had probably not yet been rebuilt. The second group of mills in Oxford were those on the "Beach" mill-site, around which the village of Beachville later grew up.

5. FRONTIER LIFE AND FARMING

The conditions of life in the first stage of settlement were very similar throughout Upper Canada, nor did the routine of clearing a holding in 1795 differ in its essentials from that in 1855. Most of what is said of the life of the settlers in this early period applies equally well to those who settled the northern part of the watershed in the 1820's and 1830's. Differences in the settlers' background and local conditions of soil and topography caused some variations. A settler whose holding included a tract of river flats was in a better position than one who had to hew all his farm from heavy hardwood bush. An area such as most of Oxford West, with a gently rolling topography, a fertile loamy soil, well drained and well watered and covered with mixed bush, allowed a quicker development than regions whose heavier and wetter soil might eventually prove quite as productive. The existence of a pinery would affect the development of a settlement as it did in Delaware and in Dorchester.

Most of the first settlers on the Thames had the advantage of having been born in North America and having grown up with the frontier as part of their

background. Even those who had been forced to give up a very different way of life had long been familiar with the idea of frontier settlement and knew what conditions were to be expected and how they were to be met. Many of the Loyalist settlers had had experience of other parts of Canada and the Americans had chosen this country as an alternative to the Western territories of the United States. In these things they differed from European settlers, particularly those of the period after 1818. To the early settlers life in the forest was natural and ordinary, a temporary stage in the building up of a prosperous homestead. To some it was the only life they had known and the one they preferred. These "professional frontiersmen" had perhaps already pioneered more than one bush farm and would sell out and move on as soon as the settlement began to fill up and new areas were opened. The majority of the Thames settlers were not of this type. They had more permanent ambitions, and were eager to see the forest clearings change into well cultivated farms. But, though they looked on the trees as a nuisance to be got rid of as fast as possible from the fronts of their holdings, they were not oppressed by the surrounding woodlands and knew how to use such resources as these offered while their farms were being established. Life during the first few years was hard and laborious, but it was not necessarily dull or gloomy. The actual settlers of this period have left few direct descriptions of their life. Most of them were too busy and too illiterate to write long letters or to publish books, and in old age they were prone to indulge in the privilege of pointing out to the younger generation just how much easier a time they were having than their grandfathers. Such scraps as have survived, however, with the descriptions of travellers (who were perhaps too inclined to optimism) give a much more cheerful impression of Upper Canada before 1812 than can be gathered from the more articulate compositions of some repining exiles of the 1830's and 1840's.

The first need was to select a location, and here these settlers had the advantage of knowing what to look for and how to find it. They knew that "pine plains" would soon lose their fertility and in spite of their liking for light, well drained land were inclined to avoid them. Pine plains were easy to clear, however, because of the absence of underbrush. Some settlers were ready to take advantage of this and exploit the accumulated humus, moving on before the whole farm was cleared. Open parklike stretches, called "oak plains", were even easier to clear and "under good management" produced well. They had the disadvantage of requiring the plough at once and settlers also disliked them because of the lack of firewood. A lot was often assigned before the applicant had seen it but in most areas it was possible to change an unsuitable lot for a better.

A hut or shanty for temporary shelter was the next necessity. A better house had to be built and occupied for a year before a government grant was confirmed, and five acres were to be cleared and cropped before the end of the second year. On roads such as Dundas Street the clearing was increased to ten acres and the house had to be 16 feet by 20 feet and reasonably well constructed. On the Talbot and Longwoods Roads a shingle roof was required. The ordinary duties were not difficult for an experienced settler. A good axeman could "chop" an acre of hardwood in a week, felling the large

trees and cutting them into lengths that a yoke of oxen could handle. Brushing, logging and burning took longer and required oxen and some extra help. A settler without grown sons and oxen had to depend on his neighbours for help, if he was to make any progress. As soon as enough land was cleared to secure the house from falling trees, a crop would be hoed or harrowed in between the stumps. Then more land would be cleared for the next crop of fall wheat.

After the wheat was planted in the fall it was the custom to cut the brush on the next year's wheat ground and pile it before the snow fell. Chopping, cutting and hauling firewood, and splitting fence rails occupied the winter, varied by some hunting and some fishing through the ice, for food more than for sport. Spring brought sugaring, and grass might be sown, just after the frost came out of the ground, on the field from which the wheat had been harvested, if this had not been done in the previous September. The rate of production on new land was greatly lowered if grain was planted a second time, and weeds soon became troublesome. For this reason it was the custom to seed down the wheat ground and leave it in hay or pasture until the tree roots had time to rot, after which it could be ploughed, still between the stumps. This rotting took several years and in the meantime the settler required only a few hand tools and the heavy triangular harrow.

When the spring crops had been planted on small patches near the house, the logging and burning of the new chopping could be begun. This was hard and dirty work; five men and one yoke of oxen were considered a good allowance for each acre of heavy timber, but in the early days many families had to get along with fewer hands. Neighbours helped each other and bees were not uncommon, but they were harder to organize in a scattered community than in the later times of more rapid immigration. Logging could be dangerous and burning was a ticklish business in dry weather, for if the fire spread too rapidly from the dry brush heaps it might seriously damage the soil or start forest fires. With a hired gang of choppers it was possible to have several acres cut and burning at the end of a day, but, unless the owner was in a position to hire farmhands or to keep more than the usual number of stock, there was little point in clearing more than was needed for one year's wheat, since it would have to be left in grass for two or three years. Wheat "pieces" were small for, with the methods in use, harvesting took time and bad weather might spoil part of the crop. Most settlers were content to advance slowly, growing only what the family needed, with a small surplus for trade. Even so a reasonably energetic man might have fifteen acres under cultivation after three winters' chopping. This would support his family, and when thirty or forty acres were cleared he had as much as he could expect to cultivate without hired help. Few settlers at this time cleared more than twice this acreage. Hands could be hired, but wages were high and help ate up profits.

The cost of carriage made it hard for the Thames farmers to compete with other parts of the Province and wheat production remained moderate for some time. In the matter of raising stock they had some advantages. Wide areas of range such as those at Long Point and on the lower Thames were lacking, but there was good pasture on the flats. The Oxford farmers kept more than the average number of cattle and by 1812 were famous for making butter and

cheese. In 1814 they had a considerable number of beef cattle for sale, though in that year it was the enemy who reaped the benefit of this production. Frontier farmers kept few cattle as a rule; eight or ten cows was a large herd. Newly arrived families might have none and this would also be the case with some labourers and craftsmen. A high average per family meant some herds of unusual size. The raids certainly reduced the numbers of stock, but many must have been hidden in the woods, and a few years after the war the average in Oxford County was three milch cows to five people. In a well settled township like Oxford West it would be still higher. This foreshadowing of future eminence in dairying is interesting, but this was still a minor activity and the surplus for sale was very small.

Pork was the mainstay of the frontier family in winter, and a few sheep were almost indispensable if the family was to be self-sufficient. Hogs seem to have been scarce in Oxford in 1799 except at Canfield's, near Oxford Centre, who seems to have been specializing in this type of stock. Before long they were as plentiful as elsewhere and the existence of a fulling mill by 1812 shows that the farmers were keeping fairly large numbers of sheep. Horses were kept in about the usual numbers. They were used only for road work and many settlers had none, but every family tried to procure at least one yoke of oxen as soon as might be. Care in breeding or in selection was only exercised with the oxen and horses. With the rest of the stock the practice of "free commons" or open range made any control of breeding nearly impossible.

By the early 1800's some farmers were giving up the yearly chopping of new ground and sowing their wheat on land ploughed out of turf and fallowed through the summer. This was the general practice in Oxford in 1817, but the answers from Dorchester imply that chopping was still going on and this would be the rule on new farms like those in Westminster. The Oxford farmers sometimes substituted peas for wheat in the first year and followed the peas by a crop of rye and the wheat by corn or oats. The "piece" was seeded down after the oats or rye—not with it; the use of a cover crop with hay seed was still unknown. Many farmers continued to grow wheat on the same piece year after year, sometimes for as long as twenty years. The answers from Dorchester in 1817 mention no following crop, so this was perhaps the practice in that township. In Oxford "cleared flats in use are 315 acres, from which corn has been taken for twenty years but in 1817 it was sowed to wheat". Probably there were even larger cornfields on the flats in Delaware. Corn was not often grown in such large quantities, for the method of planting in hills added to the labour of cultivation and the market was limited. No manure was used on the grain ground, "not being needed", but some careful farmers drew it out to the fields near the buildings where they grew small amounts of flax, tobacco, potatoes and other crops, chiefly consumed at home. It was also the custom to grow these crops on the same patch year after year.

The routine of farming formed a chief part of the life of every family, for each household was to a large extent dependent on its own produce for all necessities. Every man was in some degree a farmer, whether he was also a miller or parson, doctor, lawyer or merchant. If the farm was a settler's chief support and his location was isolated, he might also have to be skilled in a dozen crafts.

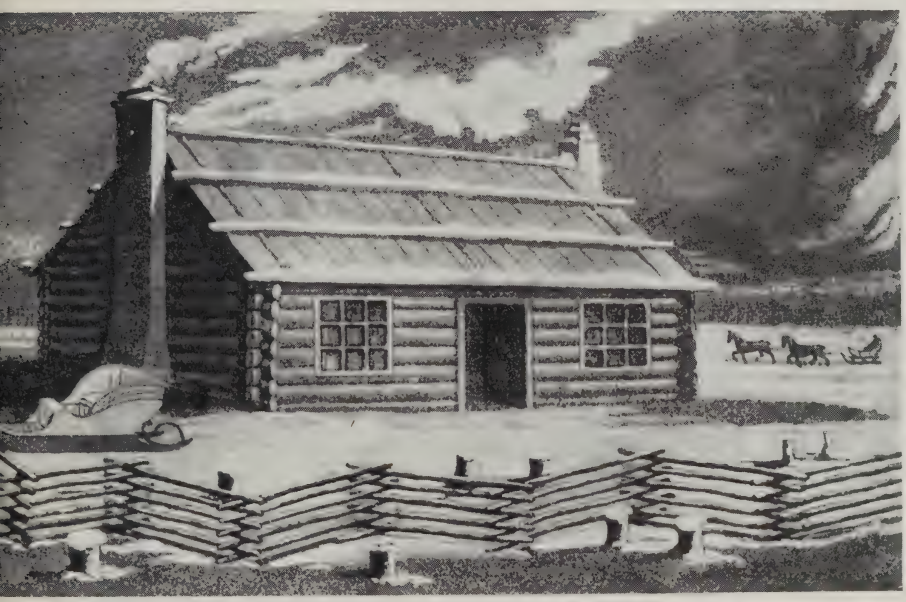
The frontier farmer was of necessity skilled with the axe, but most could turn their hand to anything from coopering pails to casting bullets and buttons. The women's duties were quite as various. They milked the cows and looked after the dairy and garden; watched the boiling of the sugar, made the soap and candles; pickled, salted and smoked the meat; dressed and spun the wool and flax and then wove and made up the blankets, linen and clothes for the family. These and many other home crafts were common to households of every type and continued to be plied long after many of the men's incidental skills had been taken over by specialists. By 1812 the settlers in Oxford at least had the services of tanners and shoemakers, blacksmiths, masons and carpenters. The fulling mill, tailors and travelling weavers would, however, take only part of the women's work off their hands, for finer cloth and tailored clothes were luxuries for Sundays, and for everyday wear the farmer continued to dress in homespun.

Such a round of occupations made life full and varied, but it left little time for other diversions. The few chances for the meeting of neighbours were eagerly seized upon as an excuse for merrymaking. Visits to the mill with grist or for trade, militia days, township meetings and court days brought the settlers together and gave the men a chance to spend some time in the tavern, hearing and discussing the news, drinking and disputing. Such tavern sessions were at the bottom of most of the suits for assault or pleas for protection that made up a large part of the business of the courts and usually ended in all parties being bound over. They also produced many of the informations of treasonable conversation that were common just before 1812.

The women of the household could rarely go on these trips; they depended for news and small wares on the travelling pedlar and for society on bees, church meetings, weddings and funerals. Even the last were occasions for a great deal of eating, drinking and gossip. Wedding festivities, however, had often to take place away from home, because of the long journey to the nearest Justice of the Peace. They were sometimes omitted altogether, while the ceremony itself might be posponed till a more convenient time. A wedding or a bee might end in a dance, but some families refused to countenance dancing, and bees in this period were smaller and more serious affairs than they became later. Any visiting was best done when the sleighing was good and the moon at the full. At first there was little room for large indoor gatherings, for houses were small and crowded and the inns little larger. Later schoolhouses provided small halls that could be used for church services and other meetings and barns began to be available for the same purpose. As we have seen, Oxford Township had at least one church building and possibly a courthouse before the war, but this was exceptional.

The houses of this period varied as much as the size of the clearings. There was no required standard on ordinary holdings and many were content with the smallest possible one-roomed cabin, with at best a low-pitched loft above, reached by a ladder in one corner. Such cabins had one large chimney of logs plastered with clay; a roof of bark or slabs, or of hollow cedar logs split and laid like tiles; and at most one or two small windows. With a few improvements these houses might suffice for a generation. Other settlers built "neat" squared-log houses at once, as large or larger than those required on

The shanty in the first clearing. From a sketch by Lt. P. Bambridge, 1839 (probably near Chatham). On the upper river the scow would not have sails.



Round-log house with slab or board roof; London Township about 1820. The sleigh near the chimney is a carriole, the one in the background, a cutter.

Squared-log house in Zorra West Township. The height of wall suggests a date in the 1860's.

the main roads; divided downstairs into two or three rooms, with a cellar and a good attic to serve as "loom-room" and dormitory. These had shingle roofs and masonry chimneys, often with a second hearth that put them in the taxable class. Even in these houses there was usually a bed in the kitchen and the parlour might do double duty as the master bedroom. Inns often had only two rooms, one serving as taproom, kitchen and eating-room, the other as a general sleeping place.

As soon as a sawmill was set up, frame buildings began to appear and boards were available for floors and wall-covering. There were several "good houses" in Oxford in 1806, but no mansion to equal Benaiah Mallory's house in Burford. Inventories attached to claims for compensation show that some at least of these houses were comfortably if scantily furnished in 1812 and well provided with linen, china and utensils. Not all the furniture was made at home. Walnut, cherry and even mahogany tables were to be found in some parlours, with one or two wall mirrors and perhaps a dozen windsor chairs. Turned bedsteads were common, but special pieces such as sofas, easy chairs and chests of drawers are more rarely mentioned.

Farm buildings at first were limited to a log stable and a hog pen. Hay was stacked, and grain stored in "barracks" and threshed on open floors, a small quantity at a time. On many farms the barn was the last building to be built and the first to be built of frame. In these barns the stables were often placed under one of the mows, on the same level as the threshing floor, but before long the bank barn was borrowed from the Pennsylvania settlers to the east. The plough and harrow remained almost the only implements; the other farm "utensils" were the same hand tools that had been used for centuries, though the American practice of harvesting with the scythe and cradle struck British settlers as a vast improvement on the sickle.

These same British settlers, or the more sedate among them at least, found some native customs rather shocking. Habits of courtship that were due to crowded houses seemed to them highly dangerous and they put the worst construction on "sparking" and "bundling". They give a gloomy picture of Canadian manners and morals before 1825. Unfortunately there is some evidence to support accusations of laxity, but the average settler can hardly have been so depraved or the filiation of their descendants so uncertain as these stories would indicate. They acknowledge that the Canadians were remarkably honest on the whole and that serious crime was rare.

Local administration was entirely in the hands of the magistrates. When a township was organized its annual meeting elected the township officers, settled the question of fences and free commons and frequently expressed the opinion of the freeholders on other public matters. The power of decision and execution, however, remained with the Justices in Quarter Sessions who controlled expenditures and to whom the officers were responsible. They managed most of the affairs of the community, often in an informal and arbitrary but not unkindly way. Their homes tended to become the centres of the settlements, for settlers had to come there on many different matters of business. Trails branched out from these houses and even when the Justice was not a

miller, merchant or innkeeper—or all three combined—the vicinity of his house was a good location for a tavern and a blacksmith's shop. A hamlet was quite as likely to grow up around these as around a mill.

CHAPTER 3

THE PERIOD OF GROWTH: 1818-1867

Emigration from Europe to North America, checked by wars until 1816, had begun again when this period opened. Slow at first, the movement gained force in the 1820's and reached its height during the 1830's. After a brief check, it continued to grow through the forties, slackening gradually after 1855. It was by this movement, of people displaced from what they regarded as their normal life, that the watershed was finally settled.

The greater number came from the British Isles. There was also a steady stream of Canadian settlers and some from the United States. The Americans settled chiefly in townships already opened, but there was little unoccupied Crown Land in such areas. To meet the demand for Crown Land, areas were bought from the Chippewas on each side of London Township, and it was some years before much of the wild land in the older townships began to be occupied.

1. THE NEW TOWNSHIPS

(a) LONDON TOWNSHIP

The only large area of Crown Lands immediately available in 1818 was London Township. Here land was set aside for a party from the south of Ireland, collected by Richard Talbot and brought to Quebec in a Government vessel in 1818. At Montreal the greater part of his settlers decided to go to the Perth Settlement in Lanark County and, according to one account, only about one hundred people arrived in Westminster Township. Other settlers entered the township at about the same time and the progress made attracted still others. About ten years later London Township contained approximately four hundred families, most with good clearings and some stock; a few good houses, stores and mills; and one unfinished church.

The founding of London had now changed the situation of London Township, which filled up quickly during the 1830's. Ten years later London was a well settled township, with many good farms and orchards. In another ten years almost all the remaining wild land had been occupied and the acreage of cultivation was growing fast. By the end of the period the rural parts of London Township must have been exceptionally populous and well cultivated.

(b) CARADOC, LOBO, NISSOURI AND ZORRA

These townships were all surveyed between 1819 and 1821. There seem to have been few squatters in Caradoc or Lobo before the surveys, though there were two sawmills in Lobo. Settlers began to come into Lobo in 1820, but swamps and some larger grants on the river kept the number within the watershed relatively few even in 1840. It was not till after the railways were built

and the villages of Komoka and Mount Brydges began to grow, that there was much progress in this part of the watershed, though other parts of these townships were by then well settled. In 1867, however, there were several woodworking mills.

(c) ZORRA TOWNSHIP

Settlement in Zorra Township appears to have begun with a few squatters near Woodstock, who had got patents for their holdings in 1820 and 1821 and who must have been living on them for two years. Several others came from the adjacent townships into the eastern part in 1820. In what is now Zorra West, settlement in the neighbourhood of Embro was begun by two brothers from Scotland named MacKay, who had blazed a trail from Beachville in 1820. Some of their friends came to join them a year later and others followed, so that before long a Highland settlement had grown up in that part of the township. When the township meeting was held in 1822, the assessment roll showed 65 "householders and landowners", most of them still in the early stage of settlement. These families would compose a population of at least 350 souls. Zorra was divided into two townships in 1845. They were both already well settled and by 1861 settlement was practically complete, for emigration from Zorra West is recorded a few years later and by 1867 Zorra East must also have been near its greatest population before 1951.

(d) NISSOURI TOWNSHIP

The first meeting in Nissouri was held in 1822. More settlers came in the 1820's, but the centre of the township remained little occupied for a long time. The first locations were on the North Branch and the east townline was being settled in the early thirties. After the opening of Blanshard the northern part of Nissouri began to be more occupied and at about the same time there was further development near Wyton, Thorndale and St. Ives. But when the township was divided between Oxford and Middlesex Counties in 1851, it was still only fairly well settled. It was during the next ten years that progress was most rapid and the two Nissouris had probably their greatest population about 1867.

2. THE SETTLED TOWNSHIPS

In the townships partly settled before 1817, large holdings of unimproved land still restricted settlement. In whole concessions of every township except Westminster, these holdings combined with the reserves to prevent settlers from buying land at current prices. Owners would not sell until prices rose, and a tax finally imposed in 1824 was too small to do much good. A change in the method of dealing with Crown Lands had more effect.

(a) "THE NEW SOUTH WALES SYSTEM"

It was decided to abolish the fees paid by ordinary settlers for their Crown grants. Crown Lands were now to be sold at auction with an upset price based on current prices for wild land in the District. These proved to run in the London District as high as 10s. an acre.

The new system came into use in 1826 and it was not long before competition for good locations was raising prices and inducing owners to sell unimproved holdings. The situation in the Oxfords was considerably improved in the 1830's, but it was ten or twelve years more before there was much change in Dorchester North. Until after 1841 this township remained sparsely settled.

(b) THE SALE OF THE RESERVES

In 1826 the problem of Crown Reserves was solved in the townships surveyed before 1824. All that remained were sold to the Canada Company. Some had already been sold or had been granted to King's College, but the Canada Company acquired lots in all the townships in the watershed and had disposed of most of them before 1840, bringing in a number of new settlers. An attempt to sell half the Clergy Reserves to the Company failed on a question of price. A few were sold each year after 1828 and the sale of the rest was ordered in 1840. The reserves then ceased entirely to obstruct settlement.

(c) COLONISTS AND ASSISTED SETTLERS

About 1830 a group of unusually influential and well-to-do immigrants were acquiring land in Blandford through the agency of Captain Andrew Drew, R.N. Captain Drew was acting chiefly for himself and Admiral Vansittart, but several retired military officers were also in the group. The officers were able to acquire fairly large holdings on which they settled down, using their considerable means to improve their lands and build comfortable houses, large by Canadian standards. The final decision to lay out a town at Woodstock was the direct result of Drew's operations and in other ways their arrival hastened the development of this part of the watershed.

The term "colonist" was often used at this time to describe immigrants with considerably more than the $550 to $600 that was needed in 1832 to bring a family of five to Canada and settle them on 100 acres of Crown Land without excessive hardship. Such immigrants were coming to Upper Canada in greater numbers after 1830. The money a colonist brought with him and the employment he created were of value to his poorer neighbours, but this policy rarely worked out well for the colonists themselves, whose habits and education were often unsuited for bush life. Sooner or later the more energetic moved to the villages, where they were usually successful in business or the professions.

In London Township the Canada Company sold half the Crown Reserves it had disposed of by 1841 to settlers whose capital averaged over £153 and the proportion was much higher in Westminster Township, where the average was £182. Almost the only assisted settlers in the southern part of the watershed were among the immigrants without means who took Crown Reserves from the Company and received some help to reach their holdings. Settlers without means bought the majority of the lots sold up to December 1840. They were most numerous in Zorra, where work could be found at no great distance and land prices were more reasonable than near London. Employment was a necessity for such settlers during the first few years. To leave their families and seek it at a distance added to their hardships. The activities arising from

the settlement at Woodstock were an advantage to the settlers in this part of the area until government projects created a different demand for labour after 1840.

Though no colonies of assisted immigrants were located in the watershed, those just beyond it helped to hasten the development of the older townships. The military settlers were assembled in camps at Delaware before being sent to Adelaide and Warwick Townships. The equipment and provisions issued to them were mostly bought in the area, houses were built for them under contract and roads opened by inhabitants of the Thames settlements. This "settlement market", which continued into the 1840's, included other colonies started by British philanthropists and the Canada Company's work in the Huron Tract. London especially benefited as the District Town and headquarters for most of these organizations, but the other villages also had their share.

3. THE CANADA COMPANY AND THE HURON TRACT

Instead of the 829,340 acres of Clergy Reserves, the Canada Company was offered 1,100,000 acres of unsurveyed Crown Lands at the same total price. The Company chose a tract north of the surveyed townships of the London District, extending from Waterloo County to Lake Huron. This Huron Tract included almost all the area drained by the Thames in the Counties of Perth and Huron. The money was to be paid in yearly instalments and from each one of these as much as a third might be deducted to cover the cost of various improvements carried out by the Company for the benefit of settlers.

The first explorations began in May 1827 and by the following autumn a sleigh road had been opened from Wilmot Township to Goderich. At that time Fryfogle's tavern was being built just east of the watershed and Sebach's was finished before the end of the year. These tavern-keepers, who had been given land and a cash bonus to build on the road, were the first settlers in the tract.

They had been joined by a few others before 1832, when the real settlement of this area was begun by bringing parties of English settlers to "Little Thames" and North Easthope Township. By 1840 there were about 1,300 people in this part of the Tract, most of them in the Easthopes, Downie and Fullarton, with only two families in Logan. Some of the settlers had made good progress with their houses, barns and clearings, and had already some stock.

The Canada Company had now begun a new system of twelve-year leases, intended to make it easier for settlers with little money to take land. It had been providing transportation to the Tract and employing settlers on roads and surveys and on improvements at Stratford. Even so the settlers, most of whom arrived without money, were getting into arrears with their instalments and finding it hard to support their families. For such people the new system was of service, though it also had some distinct advantages to the Company.

Immigrants were again coming to Canada in large numbers when the first leases were signed in 1839. The settlement of Blanshard Township, surveyed in that year, shows how quickly settlement was taking place in the forties. Between 1841 and 1844 nearly 1,000 people settled in this township and two

The Kitchen in a loghouse of the 1830's. The door with the towel led to a staircase to the attic. The furniture is typical of the 1860's.

The Parlour in the "Frame Front" of the 1850's. The door to the right led to the kitchen shown in the accompanying sketch, with the stairs to the half-storey beside it. Note the lamp—from sketches made in 1862.

years later more than half the land had been sold or leased. At this time the areas of cleared land were still small in Blanshard, Fullarton and Logan, but east and south of Stratford there were already a number of well cleared farms and nearly 65 per cent of the land in this section had been sold or leased.

Still greater numbers of immigrants were coming after 1847. Large areas beyond the Tract were being opened and, with more traffic on the roads and better markets for their produce, settlers already in the Tract were beginning to prosper. In the 1850's the better lands were rapidly being sold, arrears were being paid up, leases converted to sales and the price of land had risen by 1854 to 19s. 6d. an acre. The percentage of land sold or leased by 1861 ranged in the Thames townships from 80 per cent to 100 per cent, except in Logan and Ellice.

The large returns that the Company was now realizing from the Tract, ten years after it had finished paying for it, increased its unpopularity. Its functions as a colonizer and improver were over in the early fifties, but it continued to hold areas too wet for settlement in the sixties and some of these were not sold till 1948. Except for these lands, settlement was practically complete before 1867. It cannot be said that the Company's methods were delaying settlement in the 1850's and up to 1848 they probably hastened the development of this part of the watershed. More might have been done with a less selfish and shortsighted policy, but in spite of some bungling and incompetence a good deal that was useful was accomplished. Nevertheless it was thirty years or more before any local historian dared to hint that the Canada Company had been of any service to the settlers in the Huron Tract.

4. THE REFORM MOVEMENT AND THE REBELLION OF 1837

Although the attempt to reform abuses in granting land had a measure of success before 1830, dissatisfaction with the administration of the Province was growing. The settlers on the Upper Thames felt some of these grievances more acutely than those in more advanced areas, whatever their reactions to the main issues, and the voters of the London District had in the past sometimes supported opposition to the ruling clique. Now that a definite Reform Party existed, they were apt to elect leading Reformers, often from the more extreme group.

The division of opinion in the area hardened as the decade advanced. Elections were hotly contested and Reform candidates were not always successful. Most people were agreed on the need for reforms, but while some were irritated by the arrogance and bungling of the "Family Compact", others were more alarmed by the "disloyal" tendencies of the extreme radicals. With some notable exceptions, officials and retired officers were apt to be violent Tories, and American immigrants extreme radicals. But among the other settlers party affiliations were not usually determined by racial or social origin.

Until the beginning of 1836 it seemed possible that some reforms would soon be achieved and other issues settled without violence. There had already been riots at political meetings, usually started by Tory "strongarm" squads. Some Reformers were going further than most voters were prepared to follow

them and the Tory victory in 1836 was probably due as much to a genuine reaction as to the violent and illegal methods used to prevent their opponents from voting. The extreme Reformers, however, attributed their defeat to these practices and believed they still had the firm support of a large part of the public. When the word was given for a rising in December 1837, very few of the inhabitants of the London District joined Dr. Duncombe at Oakland, though this was partly due to the state of the roads.

The whole District was thrown into confusion. Each party believed that the other was about to burn them in their beds and nobody knew what was happening thirty miles away. Duncombe broke up his force when news came of MacKenzie's defeat and that volunteers were advancing from Dundas, Woodstock, London and St. Thomas. Duncombe himself escaped across the southern part of the watershed and reached Detroit in disguise. Some of his followers were picked up in the woods and the militia spread out over this part of the area, gathering up more prisoners on suspicion, confiscating guns and horses, looting, bullying and occasionally burning a house.

Some settlers now left the area as a result of the troubles. An amnesty published at the end of 1838 allowed most of the political exiles to return and a garrison was established at London, composed at first of militia and later of regular troops. Raids engineered by exiles and Americans disturbed the district for nearly two years. Some prisoners taken in an attack at Windsor were later hanged at London, and two inhabitants of the village were transported to Tasmania.

These executions seem to have had a sobering effect on members of both parties. The area was already returning to normal. The arrival of the garrison was stimulating trade and it was evident that the old state of affairs would not be restored. As soon as the Union of the Canadas was completed reform of the school system and improvement of the high roads were begun and efforts made to set up a system of municipal government.

This effort was not successful until 1849, when responsible government was finally achieved. In the meantime the parties waged a fierce contest for the Upper Thames counties, but there was now less bitterness in politics. The Reformers were often successful in Middlesex and Francis Hincks, one of the Reform leaders, usually sat for Oxford, though he was occasionally defeated. The rapid development of the area was changing the whole situation. The fifties brought a new alignment of parties and when the burning question of the Clergy Reserves was finally settled by a Conservative government, the Rebellion of 1837 was already passing into legend.

5. MUNICIPAL GOVERNMENT

Since 1792 the Upper Thames Watershed had officially been part of the "London District" and after 1800 this became the unit of local government. The three counties of the District, Middlesex, Oxford and Norfolk, had their own militia organizations and, as population increased, first Norfolk and then Oxford were given separate representation in Parliament and separate registry offices.

For other purposes, however, they were still part of the unwieldy London District, which also included most of the Huron Tract. In 1840 Oxford County became the "Brock District" and Norfolk, the "Talbot District". A year later the "Huron District" was formed to include the Huron Tract and some adjacent Crown Lands. Most of the administrative powers of the magistrates in Quarter Sessions were now transferred to elected District Councils.

When the Baldwin Municipal Act of 1849 set up what was practically the present municipal system, the Districts were abolished and Middlesex and Oxford Counties were incorporated, with their areas reduced by the formation of Elgin and Brant Counties. The Huron District became the United Counties of Huron, Bruce and Perth, until Perth County was separated from the others in 1853.

The townships and villages soon took advantage of the Act to set up corporations. Only one new municipality has been formed in the area since 1860, with the exception of some suburbs of London. In 1867, however, London was still the only city. Woodstock, Ingersoll, Stratford and St. Marys had become towns and Embro and Mitchell had been incorporated villages since the fifties.

6. COMMUNICATIONS

(a) ROADS

New settlement meant the opening of new high roads and several had been established by 1840. The earliest began as trails leading from the Brantford-Sandwich Road to locations in the new townships, for example the Nairn Side Road, the Proof Line Road, the Embro Road and others. Of these the Proof Line Road was the best and most travelled before 1830.

The Huron or Wilmot Road, laid out by the Canada Company in 1827-9, was the most important of the new roads and the Company laid out others to connect it with those already partly established. It also made the Goderich Road, mostly outside the watershed, but connecting by a branch with the Proof Line Road and by a side road in London Township with the North Talbot Road. Later the Company opened the Mitchell Road through Blanshard and Fullarton Townships, but with connecting roads to the Goderich Road (Thames Road), to Stratford by St. Marys and to the Proof Line Road. This road was in use by 1845 and the branches were opened within ten years. The Egremont Road was opened in 1832, across Lobo Township, to give access to settlements west of the watershed and eventually extending to Sarnia.

The pattern of main roads had practically been established by 1840. There had, however, been very little change in their condition. Improvement still seldom went beyond turn-piking and corduroy. Some stretches were still very bad. Bridges were still few and though parts of concessions and sidelines were now travelled they were usually worse than the high roads. Gravel and macadam were hardly used and the only plank road in 1840 was a small stretch built by the Canada Company near Whirl Creek.

Plank roads then seemed the best solution for the difficulties caused by the Canadian climate. They were expensive, but could be used in all seasons and were smoother than macadam. It was plank roads that the Canadian Govern-

ment began building in 1842, with a loan obtained from the British Government. The Hamilton and Port Stanley Roads and part of the Egremont Road were planked in 1842-3. The planking on the first two of these roads was 16 feet wide and the cost about $2,000 a mile. Tolls were charged to provide for upkeep. On the Chatham Road, planking was not carried beyond Delaware, but the rest of the road was improved and fairly well maintained. Other roads were improved by private "turnpike" companies after 1849. The first and best was the Proof Line Road, a gravel or macadam road, and this was carried on to St. Marys by 1851. At that time the planking and macadamizing of the Ingersoll-Port Burwell Road was nearly finished. This proved of great advantage to Ingersoll and both Stratford and St. Marys contributed to the gravelling of roads in the next ten years. The Canada Company also improved some of its high roads before 1853.

The tolls charged on these new roads were unpopular, but the roads could not have been built or kept up without them. People went a long way round to avoid tolls and a set called "Rebecca's Daughters" was burning toll-houses in the 1840's. The objection to tolls helped the improvement of other roads and after the municipalities were organized and revenue increased, these became better and were as a rule fairly good by the end of the period.

(b) RAILWAYS

The leading men of London were attempting to form a railway company before the first line had been built in Canada, but it was twenty years before the "London and Gore Railroad" (chartered 1834), became a reality as the "Great Western Railway" (re-chartered 1837) from Buffalo to Windsor. This line was being built in 1851 and reached London two years later. A branch was soon built from Komoka to Sarnia and the "Grand Trunk" and "Hamilton, Buffalo and Goderich" Railways were carried across the northern part of the watershed in 1857-8 and on to Sarnia and Goderich. The "London and Port Stanley Railway" was finished a little earlier. The Hamilton, Buffalo and Goderich crossed the Grand Trunk line from Guelph to Sarnia at Stratford and the "London and St. Marys Railway" soon connected the Grand Trunk with London and was absorbed by that company. The watershed thus had good railway service by 1860, but some areas were still not too well served and there were no lines leading north from the area and only one to Lake Erie. Much traffic had still to go by road until after 1867, but the "inland position", which had held back development, was no longer a serious check. With the railways came the telegraph, reducing the remoteness of the area.

(c) TRAVEL AND TRANSPORT

The great age of road traffic had opened in the watershed in 1843. It was not brought to an end in 1857, because of the gaps in the railway system. In the case of freight, the chief change from pioneer days was a growing use of horses instead of oxen and improvement in the design of the wagons. Even while the roads were still bad, the number of wagons grew steadily. It cost $45 to haul half a ton from Toronto to London in 1833 and might take ten days or more. The plank roads cut down both time and cost. Long trains of

wagons carrying wheat or goods were a common sight about 1850; they took the right of way when loaded and teamsters crowded the inns. The traffic on the roads leading to railway stations after 1857 must have been as great or greater.

Passengers continued to be carried in the same sort of wagons as freight until after 1830. A light wagon or spring cart could sometimes be substituted in summer, but there were not many of these taxed "pleasure wagons" even in 1841. By that time it was possible to hire a carriage and four post-horses in Goderich for the trip to London, but even with three changes it took a day and a half. After the roads were improved, this was the pleasantest way for a party to travel. With only two horses and frequent changes, they might average ten miles an hour.

Public stages began running between London and Brantford and Port Stanley in the 1830's. Covered wagons were used at first and in bad weather; closed coach bodies on sleighs were introduced very soon for winter travel and before long regular coaches were in use in summer also. These were like the ones in Western movies of today, slung on huge straps, designed for strength and carrying nine people inside. They travelled very slowly, often no faster on the average than a man could walk with ease, and started before daybreak, continuing after dark in winter. In winter with good sleighing it might be possible to average five miles an hour, possibly ten in good stretches. On some routes, like those from Paris to Beachville, or London to Chatham in 1836, passengers often had to pry the coach out of mudholes.

The new roads did not remove all difficulties, for gravel or macadam might be very heavy in bad seasons. But these were short and on the plank roads a good pace could be kept up. A more modern type of coach could be used that swayed less and made the outside seats more desirable than they had been. "Outsides" were not usual on American coaches, but in Canada there seem to have been often four places on the roof in summer from the first. Coach travel remained a feature of the life of the watershed until after the end of this period.

7. MILLS AND INDUSTRY

[a] 1817-1825

The building of mills at first merely kept pace with the settlement of the various townships. The only industry that showed much development before 1825 was distilling. There were a number of distilleries in the area, some large by the standards of the time, and these must have exported some of their products. After 1850, distilling became of less importance and there were few distilleries in 1867.

[b] 1826-1867

(1) NEW INDUSTRIES

Before long settlement was sufficient to make it worth while to produce other goods in greater quantity. Several of the principal industries of the 1860's—woollen mills, foundries and breweries—were to be found in the area

before 1840. There was one foundry in London in 1836. Two years later a second was moved there from St. Thomas and in this foundry the first steam engine in the area was set up by 1843. Before long there were other foundries in Ingersoll, Woodstock and Embro. By the end of the period iron founding was one of the chief industries in London and was being specialized in different lines. This was true to a less extent of the four towns also, especially Woodstock.

The two breweries started in London before 1840 were already well known in the Province by the 1860's. There were four others in the city in 1867 and each of the towns had its own brewery. Some owners of carding and fulling machines had power looms in the 1840's. Other factories were opened as settlement spread and by 1867 most of the cloth was made in factories. There were about fifteen in the watershed, often in small villages like Byron and Kilworth.

It was not so easy to apply water power to carriage or to cabinet making, except for some "chair-factories". These made articles that could be composed of parts turned on a lathe—chairs, tables and bedsteads. When steam power came into general use about 1845, wagon and carriage factories became numerous. There was a large and steady demand and soon an export trade as well. There were large factories in the towns and in the late sixties London "stood unrivalled" in this trade. But the industry was not yet concentrated in a few large plants and every other village had its carriage works, occasionally of considerable size and doing more than local business.

Cabinet factories, making heavier pieces of furniture, began in the early fifties. They were usually in the towns, while chair factories, which continued to flourish, were more often in villages by 1867. By that time the industry was becoming important and there were firms in London and Woodstock making organs and pianos.

Some trades that flourished during the time of rapid settlement were affected by the disappearance of woodlands. Manufacture of pearl ash and potash had been important, but grew less so after 1860. This was true of soap and candle factories, which were also affected by the introduction of coal-oil. The small village tanneries were also growing fewer and this industry was being concentrated in larger plants in the towns, where it was easier to bring bark from a distance.

Oil-refining had become one of the leading industries at London, where there were nine refineries, and there were others at Komoka and Woodstock. Building had stimulated quarrying, lime-making and brick-making. There were quarries at Innerkip, Woodstock and a few other places, besides the older and larger ones at Beachville and St. Marys. Bricks were still sometimes burned on the site of the building, but eight or nine brickyards distributed over the area were making them in quantity. Some of these were making tile by 1867 and there were a few potteries.

(2) LUMBER MILLS

(a) Sawmills

Lumbering in one form or another was of course the chief industry through almost all this period. Until after 1830, however, most of the timber was

exported as sawlogs or squared timber and the increase in the number of sawmills and in production of sawn lumber was not great in proportion to the progress of settlement. New mills were built but they were small and only slightly more numerous than grist mills. In the ten years after the founding of London, when the first villages were being built, about twelve new sawmills were built in the watershed and about twenty-eight more by 1846, bringing the total to at least fifty-three. A good deal of sawn lumber was being exported down the river to Chatham, but the local demand was probably more important, for the plank roads alone were consuming vast quantities. Within three years the number of sawmills was at least sixty-three; all but four or five were water mills. This was close to the highest number of water-driven sawmills and probably also of individual sawmills of any kind. Steam power and circular saws were already making it possible for one large mill to produce as much lumber in one year as six of the old mills with slow-moving upright saws.

Until after 1852 more than 40 per cent of the sawmills in the watershed were located in the watershed of the South Branch. Large mills at Ingersoll and Woodstock were producing well over a million feet a year and some of the small water mills were being given up. Above London the watershed of the North Branch had no large sawmills at this time and very few steam mills. There were 16 to 18 sawmills in this part of Perth County, almost all water mills of the old type that had been operating since before 1846. New steam mills continued to be built in all parts of the watershed and more water mills went out of operation. By 1867 there were about forty sawmills in the watershed, about half of them steam mills. Total production had increased, but more of the sawn lumber was now hardwood. Sawmilling was less important in the southern part of the watershed, where the best pine had been cut. The largest mills were now in St. Marys, Stratford and the villages of Perth County. There were now a number of steam sawmills around the Ellice Swamp.

(b) Stave, Shingle and Planing Mills

If these specialized mills are added to the number of sawmills the total is higher than that of 1849-50. Shingles and staves were still made by hand in the 1840's, though sawmills had long been turning out stave-blocks. Between 1855 and 1867 about eleven shingle mills and five stave factories were built in the watershed. There had been a few "planing machines" by 1850, and at the end of the period all the large towns had "sash, door and blind factories." There were large planing mills and stave factories in St. Marys and Stratford. The mills of this type were distributed over the area, but were most numerous in the northern part around the Ellice Swamp.

(c) Grist and Flour Mills

There were already millers grinding flour for export in the 1820's and as the supply of grain increased better mills were built and old ones improved to meet a demand for finer flour. The area was too far from deep water to feel the full benefit of the export trade in the late forties, but enough mills were built at this time to raise the total from about twenty-four to about thirty-three. The Huron Tract had comparatively few grist mills at this time and much of the wheat grown there before 1856 had to be taken outside the area for milling.

St. Pauls, Woodstock. One of the first brick churches in Upper Canada. The Church of 1833 was altered and enlarged in 1851 and the tower heightened at a later date. One of the original windows can be seen on the side of the tower.

Right—United Church, Embro. This large brick church replaced the log "kirk" of 1833 after about thirty years.

Below—United Church, Kilworth, 1850.

Some steam grist mills had already been built but where water power was reliable, steam power was of less advantage to the miller than to the sawyer. By 1867 there were about fifty flour or grist mills in the watershed, as well as several specializing in oatmeal, and milling ranked among the leading industries in the 1860's.

8. CITIES, TOWNS AND VILLAGES

The sites of the villages that grew up in the watershed before 1845 were decided as much by the pattern of travelled roads as by the location of the mills. Unless millsites were close by, a hamlet was not likely to grow important, but the actual site was usually at a crossroads or a river crossing, rather than at the mills. The sites of London, Woodstock and Stratford were deliberately chosen in relation to systems of communication. There were good millsites near the first two, but at Stratford one was developed at a cost that might have discouraged an ordinary promoter.

(a) UNINCORPORATED VILLAGES

There were four places that might be called villages in the watershed before 1826, all situated on the old road from Dundas to Sandwich. One of these, Ingersoll or "Oxford", was an incorporated town by 1867. The others were still among the 40 to 50 unincorporated villages then existing in the watershed. Their history illustrates the influences that affected the rest.

Delaware, the oldest village in the area, had been chosen as a trading post and a site for sawmills. "Westminster" or "Hall's Mills" (Byron) was the centre for the settlements in Westminster and London Townships. In 1825 it was a straggling settlement with mills, distilleries and stores on both sides of the river. "London Post Office" had been opened in one of the stores, but this was moved to the new village and several leading inhabitants of "Westminster" also settled there. The woollen mills were important throughout this period, but, like Delaware, the village was by-passed by the railway and Byron was only a medium-sized village in 1867.

Beachville was an important stop on the road from Brantford, as well as an early mill village and a centre for the settlements in Oxford. After 1820, the village divided this last function with Ingersoll, but its importance as a road junction was increased in the thirties by the founding of Stratford. For a few years after 1838, Beachville was the post office for Woodstock and later for St. Marys. It was a good-sized place in the 1840's, but its growth was being affected by the development of the neighbouring villages. Beachville was among the three largest unincorporated villages in 1867. Mills, quarries and stage lines connecting with the railway gave it importance.

By the sixties the railways were determining the relative importance of the various villages. Whether these were old mill settlements, like Beachville, Dorchester or Sebringville, or were crossroads hamlets, like Shakespeare and Tavistock, or new villages at stations, like Komoka Junction or Granton, they were likely to be larger than the others in the vicinity. Most of the unincorporated

villages were small, but to the farming population they were centres of considerable importance at a time when five or six miles took an hour to travel by road.

(b) INCORPORATED VILLAGES

(1) EMBRO

The village of Embro began with the building of mills about 1830 and a log church in 1832-3. The centre of a prosperous township and an important stop on the road from Beachville to Stratford, with good mill sites close at hand, Embro flourished in the forties and early fifties.

(2) MITCHELL

There was a rough tavern at "Big Thames" in 1833 and three years later the Canada Company laid out a townplot and John Hicks built a good tavern. For six or seven years there was no further activity at Mitchell, but after the road was opened from the south, stores and mills were built and by 1851 the village had made some progress. It was not till steam mills had been built to supplement the unreliable water power and the railway was under construction that Mitchell began to grow from a small village into a large one. It was incorporated in 1857 and in the early sixties had a population of over 1,500.

(c) TOWNS

(1) INGERSOLL

When "Oxford Post Office" was opened at "Ingersoll's" in 1821, the village had already a school, tavern, store, mills and distillery. Charles Ingersoll, who had started most of these activities after his return to his father's homestead in 1819, laid out a townplot in 1831. He gave this "town" the family surname, but the post office continued to be "Oxford" for about twenty years.

Until Woodstock became the District Town, Ingersoll was the centre for Oxford County. The registry office was located there and several new stores and mills had been built by 1836. The village was the second largest place in the watershed during the late 1830's, but after 1840 Woodstock soon passed it in size and importance. Lumbering and flour-milling were still important, but it was not till the cheese trade began to develop after 1860 that Ingersoll approached Woodstock and Stratford in population.

(2) WOODSTOCK

The reserves set aside by Simcoe for a town at the "Upper Forks" had been occupied by a number of squatters when the survey of a town plot was made in 1829, at the request of some of the inhabitants of this part of Oxford County, but nothing further was done until Captain Drew applied for part of the reserve in Blandford in 1832. The survey of a plot of 400 acres was ordered in the eastern part of this reserve and the streets were laid out by August 1832 and lots surveyed before the end of the year. By 1846 Woodstock was the second village in the area in population and the only one besides London that had some of the characteristics of a town.

The plank road had been detoured to pass through Woodstock. There were now a number of mills and small factories; business was good and the village growing rapidly. When it was incorporated in 1851, the boundaries were extended to include most of the present city. Several steam factories were in operation before the Great Western reached Woodstock in 1853. During the years of the wheat boom there was further expansion and Woodstock became a town in 1857.

In the 1860's sawmilling was becoming less important and Woodstock did not yet possess any advantage as a shipping point over the other towns on the main railway lines at no great distance from it. In some other ways, however, it was more advanced than the other towns in the watershed. The founding of Woodstock College in 1860 had been an event of considerable importance, for this Baptist college was the first in the watershed and the only one of its kind in 1867.

(3) STRATFORD

The Canada Company had made the crossing of the "Little Thames" a centre of their system of roads and selected it as a village site before any settlement had taken place. The location had some disadvantages and, until there was more settlement and traffic along the Huron Road, progress was slower than in the other villages founded before 1840.

The village was officially named "Stratford" in 1833; the river became the "Avon" and Sargint's tavern the "Shakespeare Hotel." With mills running, a school, church and a Company agent, Stratford was a fairly busy place by 1840.

Stratford was a larger place in 1850. It contained about four times as many people as in 1846 and was beginning to resemble a county seat. When it became the capital of Perth County and an incorporated village three years later, the population was 1,400, and when the village became a town in 1858 the figure was over 2,500. In 1867 it was possibly the busiest and largest town in the watershed.

(4) ST. MARYS

The actual founding of the third town planned by the Canada Company in the watershed was largely carried out by inhabitants of the valley of the South Branch. Thomas Ingersoll contracted to build mills at the "Little Falls" and had completed them by 1843. By that time a village had already been formed containing ten or twelve houses, two stores and a tavern. When the town plot was surveyed a year later, the Ingersolls received most of it in payment for their work and after the village had been officially named "St. Marys" in 1845, the Company seems to have taken little further interest in it.

St. Marys grew into a large village within five or six years, little smaller than Stratford or Ingersoll. Quarries had been opened by 1846 and there were already a number of small industries, among which the manufacture of potash was perhaps the most important. It was not till after 1860 that the sawmills began to produce hardwood lumber in large quantities and the wood-working industries expanded.

"River Thames, London, Canada West, from Westminister Bridge looking north." From a sketch by G. R. Dartnell about 1842-3. The flats on the North Branch remained almost empty until the 1860's.

A print made from a sketch done before the fire of February, 1844 which destroyed the first St. Paul's Church. Looking west along Dundas Street to the Court House

ondon from Westminster in 53, showing the Court House d St. Pauls Church as rebuilt 1845. A painting by James Hamilton.

In 1867 St. Marys was principally a lumbering town, but flour mills, woollen mills and foundries were busy and there was still a considerable trade in country produce.

(d) LONDON

The legislation creating a new District Town on part of Simcoe's old reserves for London was passed in January 1826, after the matter had been under discussion for some time. The reserves had been reduced in size by the lots laid out along the Wharncliffe Road in 1824, but the area in the angle of the Forks was still reserved, except for the section between Richmond Street and the North Branch as far south as Carling Street.

The survey of a plot in this area was ordered, and was carried out by Colonel Mahlon Burwell in May 1826. The original plot, extending east to Wellington Street and north to "North Street" (Carling Street and Queen's Avenue), was ample for a good-sized town, but it was soon extended to meet a keen demand for lots and by 1834 extended to Adelaide and Huron Streets.

The first house, a small log tavern, was built before the end of 1826, near the south-west corner of King and Ridout Streets. Squatters were putting up log huts before the temporary frame Court House was finished early in 1827, although permanent locations could not be given owing to delay in settling the conditions of sale. Colonel Talbot was placed in charge of granting locations, and by 1830 there were "forty or fifty houses, all built of bright boards and shingles."

A brick court house had now been finished and the village was making good progress, but it grew still faster between 1832 and 1837, when mills were being built and industries started, new stores and taverns opened and churches built. There were 200 occupied houses in 1836 and many more being built.

London was still a straggling place, full of stumps and dead trees, with only one street on which the buildings were continuous for a few blocks. Much of the business section was rebuilt in brick after a series of fires before 1845. The new village government had begun improvements after 1841, and these were carried further when the village became a town by special legislation in 1847. Three years later London contained more than 5,000 people. Steam power was being used in the factories, and with the completion of the railway, the disadvantage of an inland situation was ended. Four or five years of rapid expansion followed, lasting until after the town had become a city in 1856.

London's interests already extended beyond the watershed and by 1867 they were still wider. The breweries, iron factories and foundries were becoming known throughout the Province. The city was becoming one of the principal industrial centres of Ontario, and its position as a regional capital was already being recognized.

9. LIFE AND FARMING: 1818-1867

(a) BEFORE 1843

Though conditions in the Upper Thames Watershed were completely altered between 1818 and 1843, the ordinary details of daily life show little change from

the earlier period. Any attempt to vary the routine of clearing a bush farm during the first few years was likely to cause trouble, as some immigrants in London Township had learned by 1822. The years of isolaton and severe hardship were growing steadily fewer and on the whole both immigrants and native-born settlers were bringing more equipment to their holdings.

It was also becoming more usual for an immigrant to have a house built and a few acres chopped by contract. But to do this and buy the outfit and seed, and make a first payment on their 100 acres, was beyond the means of the majority. When an immigrant built his own house and did his own chopping, he was usually less comfortably lodged and his clearing grew slowly unless he was able to call neighbours to a bee.

In the thirties and forties bees were more often held than they had been earlier or were to be later, when farms were cleared and time more valuable. They were held on every possible pretext and people gathered from long distances, some rather to enjoy themselves than to help. No work could be done without whiskey and fights and accidents were common.

More money might give the immigrant a better start, but, unless he was unusually well-off, it did little to lighten the difficulties of the first years. No one could escape the ordinary inconveniences of frontier life—flies, bad weather, worse roads, fevers, floods and the lack of every ordinary necessity. Clearing a farm was a heavy task and in addition the recent immigrant had to contend with loneliness, homesickness and the unfamiliarity of everything from the axes to the manners of the inhabitants.

After two or three seasons the life and work were growing familiar and the loneliness was less oppressive. With stock increasing, the front fields cleared and the cabin tight and snug, the Irish cottars and many Highlanders were better housed and fed than they had ever been at home. For others life was still rough and hard, but, with mills and smithies within reach, stores better stocked and something to trade or sell, there was less need to contrive makeshifts or do without.

By buying a reserved lot in a partly settled township the immigrant could have some of these advantages from the start and by taking an improved farm he could begin at the point reached by neighbours of ten to twenty years' standing. The settler without means could do this by renting on shares, for the landlord provided everything but half the seed.

Where a family had inherited an established farm, the old life continued as much from habit as from force of circumstances. Land was still cultivated in the same way as when it was first possible to use the plough. Crops were reaped with scythe and cradle, though they were now more commonly housed in barns, and often threshed and cleaned with horse-power machines by 1841. Well tended farms with better buildings, orchards and gardens were already giving parts of Oxford and Westminster Townships an appearance that by contrast reminded travellers of England. In the 1820's these clearances still resembled islands in an expanse of wild land, but they were already growing more continuous along the high roads and extending outwards toward smaller clearings in the back concessions.

On Commissioners' Road, West of Ingersoll.

"Our House, London, Upper Canada." Sketch by G. R. Dartnell, 1st Royal Regt. (at London, 1841-3). The house stood near Westminster Bridge.

Store in the North part of Beachville, a type used from an early period.

To the immigrant who settled in such areas before 1845, the life that went on in the new frame or squared-log houses must, however, have often recalled the England of fifty or a hundred years earlier. Such crafts as candle-dipping and soap-boiling were no longer carried on in England except in poor cottages or remote districts. The brick ovens flanking the kitchen fireplaces were new to Scottish settlers, but to the Englishman they seemed merely old-fashioned as did the lack of a pump in the new wellhouses. The huge log fires blazing on open hearths excited wonder and admiration. Their light was a welcome addition to the glimmer of one or two dipped tallow candles. The new settlers showed as much reluctance as the old to adopt the stoves that were beginning in the 1830's to be used for cooking and to supplement the heat of the fireplaces. Stoves were expensive before 1843 and the extra light was not the only advantage lost by enclosing the fire.

Shortage of cash still plagued farmers and merchants and kept going a number of home-crafts. Some of these were now a source of profit, though usually only in trade or credit. The merchants found a demand in the new settlements for homespun woollen goods, socks, stockings, mittens and straw hats made by the farmers' wives and daughters. In exchange they would give English goods that were becoming plentiful and comparatively cheap by 1840. In the settlements the women were wearing English prints instead of their hand-woven linsey-wolsey stuff gowns. The men stuck to the strong homespun cloth and flannel for everyday wear and in the backwoods both sexes dressed in homespun.

(b) FARMING

(1) WHEAT-GROWING

Farmers were keeping more sheep by 1840 and improving the breed with imported Leicesters and Southdowns, but there was little incentive to expand on other lines, for there was a limit to the amount of trade that a family could use and cash could only be counted on for wheat. A limited demand made wheat prices uncertain and the acreage of wheat was increasing slowly. In the early forties, however, there began to be a greater export of grain and some trade in wool, pork, beef and hides. The shortage of cash became less acute, for less was being exported to pay for imported goods. The demand for wheat grew steadily, though prices were lower than they had sometimes been in the 1830's. By 1850 hogs, cattle and cheese had begun to be exported in larger quantities. At the same time there was a demand for provisions of all sorts from lumbermen, railway gangs and settlers in new areas.

Farmers had been turning from subsistence farming towards production for sale, depending chiefly, but not entirely, on wheat. Prices had begun to improve; acreage and total production to increase; but yields per acre continued to be low. By 1852 the introduction of a new spring wheat was reducing loss from rust. Yields became better and for a few years the Thames farmers enjoyed an immunity from the wheat midge that was ruining crops farther east. When it reached the area in 1854, it had become known that the spring wheat suffered less from this pest and for the rest of the period very little fall wheat was grown in the area.

In 1854 the Crimean War and the Reciprocity Treaty with the United States raised the price of wheat higher than it had been since 1815. With prices ranging from $1.50 to more than $2.00 a bushel, wheat-growing became extremely profitable. The price had fallen by 1857, but soon rose to over $1.00. The demand during the 1860's was less stable, but wheat continued to bring farmers a good profit and remained the principal crop until after 1867.

Farm practices showed less improvement during the time of wheat-growing than might have been expected. Immigrants were recommending rotation of crops, manuring and draining, and subsidized agricultural societies under the Provincial Board of Agriculture were trying without great success to induce the average farmer to adopt better methods. The best system in common use was based on that reported from Oxford Township in 1817. Summer fallows and crops of other grain, usually peas, were alternated with wheat for several years and the land then seeded down to hay and pasture. Some farmers used only fallow between crops of wheat or sowed wheat year after year on the same ground. Wheat fields were not usually fertilized and liming and draining were rarely used. Other field crops were grown without rotation, though some of these got whatever manure was available. Towards the end of the period the acreage of pasture and the supply of manure were increasing and tile drainage was beginning to be used.

(2) IMPROVEMENT OF STOCK

The immigrants and the agricultural societies were able to do more to improve the breed of stock. Horses had begun to replace oxen for heavy road work in the 1830's and for field work by 1850. The breed had been improved by imported stock and by the 1860's most work horses had a marked Clydesdale strain. Farmers were breeding and keeping good blood stock for driving and there was a lively interest in racing and horse-trading. During the Civil War a trade in horses grew up with the United States which survived the repeal of the Reciprocity Treaty in 1866.

A similar improvement in the breed of cattle took place after 1850 and the small hardy cows of the pioneers were replaced by useful grade Durhams and Ayrshires. The change had been encouraged by the exhibitions held by the agricultural societies and stimulated by the interest in dairying and the trade with the United States. This trade became more important during the Civil War and included milch cattle, for the milch cows from Oxford County were considered the best by American dairymen.

The half-wild swine had disappeared even earlier. Hogs were fattened on the peas grown in alternation with wheat. Production of pork was, however, not so large as it might well have been if the farmers had been willing to raise the bacon type demanded by the packers for the overseas trade.

(3) DAIRYING

In the same way butter-making, the only form of dairying of much importance in 1842, remained a sideline because farmers would not take the trouble to improve the quality for the overseas market. A good deal was made and ex-

Early stone house on the North Branch near London.

Farm-houses "built by wheat".

Above—In Blandford Township, Northeast of Woodstock.

Right—on the South Branch above Innerkip

ported from the area, but Canadian butter had a bad reputation. Carelessly made, it suffered still more in handling and shipping and brought only the lowest price.

Specialization in cheese-making had begun in Oxford County by 1841. A market was gradually built up, first in the Province and then in Great Britain. The success of the pioneers made others turn to this type of dairying and by 1860 the county was producing hundreds of thousands of pounds of cheese each year. Some farmers already had large dairies and herds, while some were already buying milk to make into cheese. This part of the watershed was ready for the great expansion of the industry that followed the building of the first cheese factories in Norwich Township in 1864. Factories were soon being built in all parts of Oxford County and by 1867 a beginning had been made in other parts of the watershed. Ingersoll and Stratford were already centres of the cheese trade, but the development and organization of the industry belong to the next period.

All these tendencies to a more diversified type of farming were only beginning in 1867. Wheat growing was still at its height and it was not till some years later that prices for Ontario wheat began to decline. It was, however, fortunate that the Thames farmers were turning to various forms of stock raising, rather than substituting barley for wheat as was being done in other parts of the Province. Some damage had inevitably been done to newly cleared land by a system of heavy cropping and naked fallows. There was talk of exhausted farms "on the Thames" in the sixties. The yield per acre was falling, but there were other reasons for this besides erosion and over-cropping. Except in a few areas of light soil and steep slopes the damage does not seem to have been serious or permanent.

(c) THE WATERSHED IN 1867

More than twenty years of almost unbroken prosperity had completely changed the watershed by 1867. In most townships the proportions of cultivated and wild land on the average farm had been reversed since 1840. Settlement was almost complete and the change to steam power had taken place ten years before. Backwoods life had gradually disappeared. The old method of planting with the hoe or harrow was being forgotten and many types of horse-drawn implements were in use. Reaping and mowing machines had not entirely replaced the scythe and cradle, but they were already beginning to be common. There was hardly a farm in the area where some new building had not been put up since 1850 and at the same time villages, mills, churches and schools were being built in every part of the watershed. All the trades connected with building were flourishing.

Perth County is said to have been "in the log-building stage" until 1867, but there were already many frame houses and barns in that county, though not many of brick or stone, except near St. Marys. In the southern part of the watershed building with logs had practically ceased and brick or stone was in common use.

A farmer with 60 to 80 per cent of his land cleared and a fair proportion of wheat ground was well able to afford improvements. Already in 1851 such settlers were changing their way of life, buying more in the stores and making less for themselves, keeping a hired man, driving a good horse in a buggy and demanding better accommodation at the inns.

Most farmers in the watershed were in a still better position after 1860. In spite of pests and years of low prices they had been getting on the average a much better return from their wheat ground and also from their stock and minor crops. Their expenses had risen very little, though there was grumbling about taxes. The dollar would buy nearly as much of whatever was available as in 1842 and from five to six times as much as today. Labour was more plentiful than in 1851 and a good hired man was still paid $10 to $15 a month with board.

Factories were turning out goods in greater quantity and variety at lower prices. Less time had to be spent on making goods for sale or use and there was more leisure for social activities, for reading and study. In the roomy houses, heated by stoves and lighted by lamps, such occupations were carried on under much more favourable conditions. The change made by the introduction of coal-oil for lighting just before 1860 was as great as that caused by electricity about the turn of the last century, and it was not limited to the larger towns. It came at a time when the system of free public schools was already reducing ignorance and prejudice, widening interests and increasing the number of readers.

A number of schools were opened in the watershed under the system set up in 1816, although this placed almost all the expense of "common schools" on the settlers, with a minimum of financial help and supervision from District and Provincial Boards of Education. A great advance was made when the system was reformed in 1841 and some of the settled townships were already well provided with common schools when this was replaced by the Public School System in 1847. From 1837 to 1841 there was only one school in Perth County, at Stratford, and only a few were opened before 1846. The new system was practically the one now in use and by 1867 there had been schools in every part of the area for nearly fifteen years. The London District Grammar School, moved to London in 1828, was for a long time the only one in the watershed. Others were opened in Woodstock (1848) and Stratford (1853) and by 1867 there were grammar schools in Ingersoll and St. Marys.

Until the founding of the Canadian Literary Institute (later Woodstock College) in 1860, students had to go outside the watershed to attend college. Huron College, founded at London in 1863, was chiefly a theological college for the Anglican Diocese of Huron, but at this time was also open to ordinary students.

In the first part of the period life in the villages had some points in common with that on the farms. The households were organized in much the same way and often provided much of what was used by the family. Life was more varied and interesting and there were differences in dress and habits. But the close dependence of the village on the country produced common interests and some

similarity of outlook. In the towns of the sixties there had been little change as far as the arrangement and convenience of the houses were concerned. Most town families had to be content with stoves and lamps and at most the convenience of a cistern pump on the kitchen sink. Furnaces and private water systems were sometimes found after 1851, but no place in the watershed yet had a public water system and only London had gaslight.

In 1817 the watershed had contained only a few scattered settlements, the inhabitants almost all engaged in a primitive type of subsistence farming. Most of the area was still covered with forest. The watershed of 1867 had a fairly even balance between urban and rural development. The countryside and villages were busy and populous and the towns, already of good size, were entering on a new phase of development.

CHAPTER 4

CHANGE AND ADJUSTMENT: 1868-1914

The fifty years after 1867 were marked in Ontario by alternate periods of prosperity and depression. These affected both business and agriculture, but not always at exactly the same time or to the same extent. The years 1867-75 have been called "the Great Boom Period", but for farmers they were not altogether free from anxiety. The depression that suddenly struck the United States in 1873 did not seriously affect the towns of the area until two or three years later, and the farmers had solved some of their difficulties before it was over in 1881. On the other hand, in the late eighties and early nineties the farmers were suffering severely from a depression that was shorter and less severe as far as the towns were concerned.

The urban population grew greater with each decade, but after 1880 this increase took place chiefly in London, Stratford and Woodstock; the other towns and the villages were progressing slowly or losing ground. The progress of the larger centres was due at first to the extension of the railways and later to developments in industry. At the end of the period these developments were increasing the movement of population from the rural parts of the area that had begun in the seventies as a result of difficult conditions in agriculture and the opening of new farming and lumbering areas in the West. The majority of farmers met their problems by developing a new type of farming and improving their methods and this change in agriculture is one of the outstanding features of the period.

1. THE GROWTH OF THE TOWNS

All the towns were growing during the prosperous years before 1876, especially Stratford and Mitchell. Mitchell had become a town in 1873 and during the next eight or nine years had been at its most posperous, for the population in 1881 was the highest ever recorded. Stratford had gained an advantage when the Grand Trunk opened locomotive repair shops there in 1870. Between 1871 and 1876, while a railway was being built to Listowel, Stratford is reported to have gained 4,100 inhabitants. Bad times checked this development, in spite of a growing trade in cheese, horses and cattle, and there may have been some loss of population in Stratford between 1878 and 1881.

County Buildings, Stratford, with part of Victoria Park.

Embro, looking south to the Corners. The third of the early buildings to the left is a house of unbaked brick.

In the same way the new railways enabled Woodstock to make substantial gains in the 1870's, though the improvement was more noticeable after 1881. These gains were to some extent made at the expense of Ingersoll and Beachville, for the new lines drew traffic from these stations. Ingersoll was more severely affected by conditions in lumbering and agriculture. The town made little progress in the seventies and still less in the eighties.

The early eighties were a time of prosperity for Woodstock. Its importance as a market town was increasing and its industries were expanding. Stratford became a city in 1885, though in size it was still only a large town. It was becoming more than ever a railway centre and its industries were being reorganized and expanded. The much more important expansion at the turn of the century began another period of rapid growth in Stratford and by 1914 it was much more of an industrial city than it had been twenty years before.

Woodstock had been growing more slowly since 1891. Stratford had now the advantage of rail connections extending to Georgian Bay, with no large place nearer than Owen Sound. Woodstock's sphere of influence was more restricted. The smaller towns were losing business to their larger neighbours and the railways opened after 1881 did much less to increase their importance than would have been the case earlier. Mitchell was growing steadily smaller, the population of St. Marys remained almost the same for thirty years before 1911, and the population of Ingersoll did not reach 5,000. The towns had been progressing in other ways and there had been some new developments in their industries, but these did not make up for a gradual loss of local trade until the war began to stimulate some types of business, while depressing others for a time.

2. LONDON

Local conditions no longer affected London so directly as they did the other large towns in the watershed. Business in the city suffered when times were bad in the whole region or throughout the Province, but this hardly checked the growth of population. In the sixties and seventies London had been expanding into suburbs, some of which had been separated from the townships as villages by 1878. Since most had become part of the city by 1901, progress had been steadier than the census figures indicate.

This steady progress continued during the early years of this century and by 1914 London was a city of nearly 50,000. In industry and business it was still more widely known than before 1870. Since the founding of the University of Western Ontario in 1879, London's importance as an educational centre had been growing. It had on the whole kept pace with the other major cities in the improvements that were changing urban life in this period. The city had a waterworks and a street railway in the late seventies and the process of improvement was carried on through the rest of the period with the erection of new buildings, the opening of hospitals, the embellishment of parks and the electrification of the street railway after 1890.

3. THE DECLINE OF RURAL POPULATION

The rural population of most parts of old Ontario was growing smaller after 1870. The movement from the country was less marked in the Upper

Thames area than in some other regions. It had begun before 1871, with a considerable movement from Blanshard Township and a smaller one from Nissouri East. Some other townships had smaller populations in 1881 than in the previous census, but in several cases part of the loss was due to extensions of the limits of separated municipalities. After 1881 the movement became more general, though the percentages of loss were smaller than in Blanshard in the seventies.

Some of these people were moving into the towns, but the great majority were leaving the Province, usually looking for cheap land in the West. This kind of movement to new areas had always gone on to some extent, but the places of those who left had been filled by newcomers and it had not included many owners of land. A number of influences were at work to induce people to try their luck elsewhere. It was no longer easy for farm workers or young men to establish themselves on land in the area.

During the bad times after 1885 many more farmers found themselves in difficulties and much of the loss of population in the 1880's took place in these years. In the late 1890's the movement slowed down slightly, but it was more marked after 1900. There was a considerable emigration to the West in this decade, but the movement into the towns was now more important than it had been. The villages had maintained their population during most of the eighties. The concentration of industry in the towns began to affect them in the nineties and business was reduced by the competition of city stores as well as by the emptying of the countryside.

Until 1885 this cannot have been very noticeable, except in a few areas. Not many farms were left unoccupied before 1891 and there are even now no large abandoned areas in the watershed. But, though few houses were vacant, the households were smaller than they had been and fewer young people stayed at home after they were grown up. By 1914 the villages were decidedly smaller and less busy, there was less traffic on the roads, fewer hands in the fields and fewer pupils in some schools.

4. COMMUNICATIONS

(a) RAILWAYS

A second period of railway building in the watershed began in the early 1870's and by 1879 lines had been completed from Port Dover through Woodstock and Stratford to Listowel, from St. Thomas to Galt by Ingersoll, Beachville and Woodstock and from London to Goderich. The opening of these lines added considerably to the importance of both Stratford and Woodstock and by changing the direction of traffic they increased the importance of some villages and reduced that of others. Even places on the railway were affected, for the local traffic was now divided among more stations.

It was more than twenty years before any new lines were built. In 1891 the Canadian Pacific Railway built a line from Hamilton across the watershed, passing through Woodstock, Thamesford and London. In 1908 this line was connected with St. Marys by a branch from Zorra Station by Embro and Lakeside and two years later this was connected with the line from Ingersoll to Tillsonburg, built in the nineties.

Though built under different charters, all these lines formed part of the Canadian Pacific System. Most of the others in the watershed were now part of the Grand Trunk System. The London and Port Stanley Railway was eventually electrified, but before there was any important development of electric lines in the area motor vehicles were already making them unnecessary.

(b) ROADS

There were no additions to the high roads in this period. The improvement of the roads was carried on in the seventies and some new road companies were formed. After 1880 tolls were gradually abolished and by the nineties the roads were on the whole in good condition for horse-drawn vehicles. The motor car was still a rarity in 1900, but before 1914 motor traffic was increasing and the need for hard-surfaced roads was beginning to be recognized.

5. THE DEVELOPMENT OF INDUSTRY

Though there were some notable additions to the types of industry carried on in the watershed, the principal industries remained the same as at the beginning of the period. Their organization, scale of production and distribution had, however, been radically altered by 1914. This change had begun by 1867, but was limited largely to London, where certain large firms, well-known today, were established before 1870. These firms did not then dominate a particular industry to the same extent as after 1900. There were many more separate foundries, breweries, oil refineries and carriage factories in London in 1870 than were to be found there thirty years later, when the production in most of these lines was very much greater.

This same process was hastened in the rest of the area by the depression of the later seventies and by conditions existing during the 1880's which gave the advantage to larger and better organized enterprises, located near the railway lines. The policy of high protective tariffs, introduced in 1878, did not do all that was hoped to stimulate Canadian industries, and business in the 1880's was on the whole less brisk than it had been before 1876. There had, however, been a good deal of re-organization and expansion in the towns by 1885. Plants were enlarged, machinery improved, and more hands employed. Some of the smaller plants had gone out of business and there was a tendency to reduce competition and overlapping by limiting the variety of goods produced. Some foundries had become implement factories, while others were producing only machinery or stoves and furnaces. Furniture and carriage makers were reducing the amount of hand work and other factories were standardizing their products.

Plants located in villages were now at a disadvantage in respect to labour supply and, unless they were on a railway, in respect to fuel as well as transport. The wood used to stoke their engines was becoming scarcer before 1880 and coal was being substituted. A gradual decrease in the number of village industries and of mills took place in the 1880's and 1890's. The death or retirement of the owner often led to the closing of a plant and it was frequently considered not worth while to rebuild after a fire.

Near Dorchester Station. A grist mill had been added to the sawmill of 1800 by about 1840. The dates over the door record later rebuildings.

At Beachville—the only survivor of the water mills in this village has been altered and extended more than once. The first mills were perhaps six years old when they were burned in 1814.

Flour mills were not so much affected until the end of the period. Millers were having difficulty in Ontario in the seventies, but a number of old mills were rebuilt or enlarged in the nineties. Though practically no new mills were built, very few of the existing ones were given up altogether before 1914. The larger mills continued to grind flour and the smaller mills were kept going by the demand for feed and chop. Water power was still used to a considerable extent and it was in this period that most of the old water-wheels were replaced with turbines.

Permanent sawmills were fewer and less important than they had been even in the towns. Practically all the water sawmills had been given up by 1900 and during the revival of lumbering in the 1880's much of the lumber, lath and shingles were produced by portable mills, set up temporarily near a good supply of suitable timber. The other wood-working trades tended to be concentrated in the towns and were doing largely a local business. Carriage factories and woollen mills were becoming fewer. Some of the latter continued in operation till the war broke out, but for various reasons there was less demand for carriages, although the motor vehicles can hardly be said to have been generally used even in 1914.

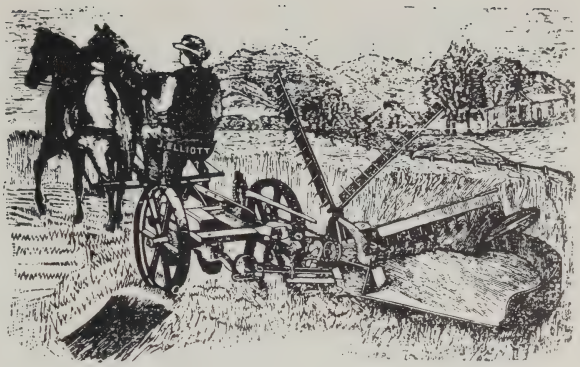
In the cities and towns a new period of re-organization and expansion began in the late nineties. The larger places were now attracting industries from outside the area and for some years after 1900 their possession of electricity was an added advantage. There had been some new developments. The demand for farm machinery had become much greater after 1880 and now included cream separators and other devices used in dairying and to save labour in the barns. There were implement works in all the towns of the watershed and most of these were making farm wagons also. The demand for cement and chemical fertilizers had an effect on quarrying at St. Marys and in the vicinity of Beachville and Ingersoll. New needs had produced other new industries, bridge ironwork, windmill towers, fencing, bicycles and ready-made clothing, all being made in Stratford in 1903. The manufacture of furniture had become important there as well as in Woodstock.

In all the towns the industries directly connected with farm produce—the manufacture of butter or cheese or the packing business—were expanding after 1895 and with the trade in produce were making business much better than it had been in the 1880's. The industry of the area was beginning to be organized on its modern basis by the time the war began to make new demands upon it and opened a new era of development.

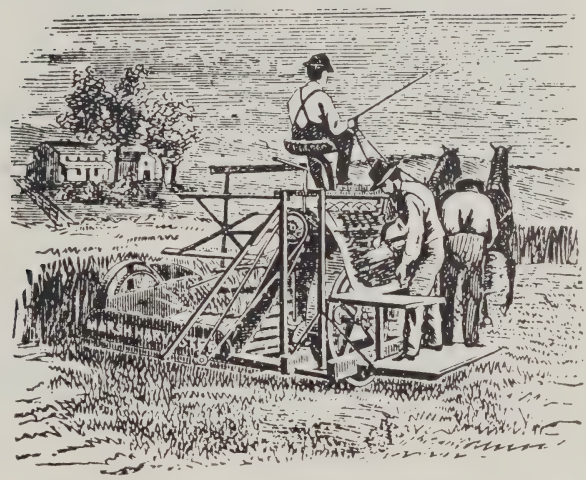
6. CHANGES IN AGRICULTURE

(a) THE END OF WHEATING

The dependence on wheat for the chief cash return had already become considerably less in 1867 and within a few years farmers who continued to grow large quantities of wheat were experiencing trouble from both lower prices and smaller yields. Prices for Ontario wheat on the Toronto market were tending downward on the average before 1869, when there was a sharp drop in price. This rose above a dollar in a little more than a year and was steadier until 1875. The price then fell below a dollar and only once in the next fifteen years rose



"Buckeye" Self-Raking Reaper, 1869. A popular type 1860-1885. Sheaves were bound by hand and four or five "binders" were needed to keep up with the reaper



"Marsh Harvester", 1871. Made in Canada from 1866, this type proved unsuccessful, but introduced several features used in the binders of the 1880's.

Ploughing in the 1840's. From a Montreal advertisement—1851. A single small wheel was more usual in Upper Canada. Mould-board and share were cast in one piece.

as high as it had been in the late sixties. Production, acreage and yield per acre in the southern part of the area were far lower in the Census of 1871 than in the previous return. In Perth County they continued to increase for another ten years. Through the late seventies and eighties better seed and better practices produced a much greater average yield and total production rose higher than before, but though wheat was an important crop the era of wheat farming was over by 1880.

(b) IMPROVED METHODS

The fall in the price of Ontario wheat had been due in part to a deterioration in quality from the use of poor seed and from careless farming. The hard western wheat did not come on the market in Toronto in any quantity until after 1880, though the production of the southern prairies was affecting the export trade in the seventies. By the late 1860's the need for some change in the agriculture of the Province was being recognized and the founding of the Agricultural College at Guelph and the Royal Commission on Agriculture of 1881 were the result. The evidence heard by the Commission revealed a considerable swing towards mixed farming, and some improvement in practices. This improvement continued during the next twenty-five years and by the end of the period crops were being grown in regular rotations; the fields were receiving much more manure; chemical fertilizers were coming into more general use; roots were grown in greater quantity; legumes were beginning to be used and crops were sometimes ploughed in for fertilizer.

New types of wheat had been introduced, allowing a return to fall sowing. Greater care was taken in the selection of seed and in keeping down weeds. The lessened use of fallows and longer periods in turf did something to reduce erosion, but conservation practices as they are now understood were still unknown and much topsoil was still lost every season. However, there was much more being done to preserve and improve fertility and on some farms the advance since the sixties was very notable.

(c) MIXED FARMING

When wheat farming began to be an uncertain resource, the farmers of the watershed turned to dairying and the breeding of stock, developing the trade that had grown up before 1867. Next to dairying, which will be discussed separately, the breeding of horses and cattle for export was perhaps the most important activity in the seventies and eighties, though the production of pork was already increasing.

The trade in heavy draught horses became a speciality in Perth County after Thomas Evans of Blanshard imported a pure-bred Clydesdale stallion in 1867. The demand was due to the great increase in the mining, steel and brewing industries and became still more important in the ten years after 1875. In the southern part of the area a lighter type of horse was bred for export in considerable numbers. These were used to pull the cars of the street railways. When the American farmers began about 1885 to meet the demand for the

heavier type, breeders in Perth also turned to this type of horse. This trade helped to carry them through the bad years of the late eighties, but failed them when the street railways were electrified after 1890.

The trade in cattle with the United States was another resource in the early seventies and by 1876 cattle were being shipped from the area to Great Britain. This overseas trade was stimulated when quarantine regulations gave Canadian cattle a decided advantage that lasted from 1879 until 1892. By that time the trade was well established. Production slackened slightly during the nineties, but had reached a high figure by 1910, although the development of dairying was having some effect.

It was during this period that sheep ceased to be kept in any quantity on most farms in the area. The rise of dairying had already caused a decline in numbers in Oxford County by 1860, and after 1870 both numbers and production were lower in the southern part of the watershed and in Perth after 1885. The farmers no longer needed wool for their own use, and in the market they had to meet the competition of Australia and New Zealand. The keeping of sheep was a minor activity by 1900.

Production of pork declined still further in the seventies, but after 1880 the farmers began to produce the type required by the packers and the overseas trade began to grow stronger. By 1900 the production of pork in the watershed was greater than ever before and the shipments overseas grew greater until about 1909, when disputes with the packing houses over prices caused farmers to reduce production. The trade had not recovered before war broke out in 1914.

Besides the developments in stock, farmers were finding other profitable activities. Much of the acreage of wheat was replaced by pasture or hay and oats. There was a good demand for feed in the towns and near London barley was grown in some quantity for brewing. In the north-western part of the area flax was cultivated and there was a demand for eggs for export. These were, however, minor and local activities.

(d) DAIRYING

(1) CHEESE

The "cheese mania" that had begun in 1866 was at its height just before 1870. Factories were opened in such numbers that they interfered with each other's business in certain areas. They varied considerably in size and organization, some being private ventures of individual dairymen or of companies and others being managed on a co-operative basis. The quantities of cheese produced were large and the profits high by the standards of the time when the factory was well managed. But the quality was often poor, for some of the cheesemakers engaged to run factories had little experience and less knowledge of the importance of cleanliness. The decline in quality threatened the export trade, which was already well organized when factory methods began to be used. There were also difficulties about marketing and prices. These troubles were overcome in the seventies by the efforts of the dairymen's associations and the setting up of cheese boards in Ingersoll and Stratford. The quality of the

cheese improved, more care was taken in handling it and the production in the southern part of the area was very high in the early eighties and was increasing more slowly in Perth County.

This progress was checked before 1890 and much less cheese was produced until after 1900, when there was a marked rise in the export to Great Britain. This trade reached its peak about 1904 and even in 1910 the production of cheese in the watershed was greater than at any time before recorded in the census returns. In the next few years it dropped below that of 1870 and had not recovered when the war began.

(2) BUTTER

Butter remained a home industry until the turn of the century when some cheese factories began to make butter and some butter factories were opened. There had been a movement to induce farmers to take more care in the making of butter and this had had some effect by 1890. The number of factories making butter was a little larger by 1900, but the expansion of the cheese trade checked production and even in the years before the war, when less milk was being used for cheese, the quantity produced was not very great by comparison to more recent production in some parts of the area.

There were already some other outlets for milk in 1914 which were just beginning to have some importance. There was a greater demand for whole milk in the cities and the manufacture of condensed and evaporated milk had begun.

(e) UNDERDRAINAGE AND IMPROVEMENTS IN EQUIPMENT

Field tile was being made in the area before 1870 and some draining of wet land was taking place in the seventies. The Ontario Farm Tile Drainage Act of 1878 made Provincial funds available to the municipalities for loan to farmers for this purpose and comprehensive drainage schemes could now be carried out. A good deal of wet land was brought under cultivation in good times. Much of this needed only draining to make it valuable, but enthusiasm for drainage was perhaps sometimes carried too far.

Many kinds of implements were already in use when the period opened and these were gradually improved until they approached the modern types. As labour became scarcer they came into general use. Some important additions were made in the late seventies and some, like the cream separator and steam tractor for threshing, were soon in common use. The most important change came after 1880 when the mechanical binder reduced the number of hands needed in harvesting by fifty per cent.

There were also improvements such as the introduction of ensilage in the eighties and better planning of barns and stables and in their equipment. Much of the equipment now used was to be found in 1914, but it was designed to be used with horses, and tractors were rarely seen in the fields. Only a few farms were equipped with all the latest devices, but every farmer had the machinery needed for working the land and sowing and reaping the crops.

Log house and frame barn —a combination often seen after 1845.

South Easthope Township.

An early frame house on the Embro Road, Gore of Downie.

A fine stone house in the fashion of the 1870's, on the Embro Road.

In the thirty years after 1870 the conditions of daily life in the towns were changing much faster than in the countryside. Gas companies were started in some places in the seventies and by 1900 all the towns had waterworks, though some had been slower to adopt this improvement than others. Most towns had their own electric power plants before the Hydro-Electric Power Commission was established. They had been installing drainage systems, improving the streets, planting shade trees and laying out parks. Public buildings and schools were rebuilt on a larger scale. Churches, houses and stores were altered or replaced with new ones and most of the existing buildings date from between 1870 and 1900.

During each period of good times a good deal of building and altering went on in the country as well. Many of the small frame houses in Perth County were replaced by large ones of brick or stone in this period. The new houses were larger and more comfortable in some ways than those of the fifties and sixties, but they did not as a rule contain many more conveniences. Furnaces and bathrooms had become not unusual in the towns, but in the country they were still exceptional in 1914. In most areas this was also true of electricity, for the great extension of rural Hydro came after the First World War. One great improvement of the 1880's, the telephone, was quickly adopted in the country. By 1900 it was in general use and made life on the farms less lonely and isolated, especially for the women.

Apart from new interests arising from the new type of farming, the events of the mid-seventies made little difference in the life of the watershed. The farmers' expenses were increasing, especially the expense of commencing farming, but so was the value of their property and up to 1885 returns were sufficient to maintain their standard of living. The depression that began a few years later had a different effect. It could not be met by turning to new activities for the market for almost all produce had collapsed. It lasted long enough to exhaust the farmers' reserves. When conditions improved after 1895, most farmers were much less secure financially and in many cases their standard of living had been lowered.

The movement from the countryside was now beginning to have a definite effect on its life. The farmers' difficulties had affected business in the villages and they were growing smaller. The various activities that composed the social life of the rural communities were harder to carry on and, though the work was easier in some ways, it was no longer carried on in company with others. On the other hand the cities offered a much greater variety of occupation and greater opportunities for recreation.

In some areas and on individual farms the effects of the bad times had been repaired by 1900, but in others they remained visible even after the prosperity of the next ten or twelve years. The contrast between conditions in the country and in the city grew sharper after electricity was introduced. It was only here and there in 1914 that the Hydro was beginning to make some change and that the motor car was allowing farmers to share more in the life of the towns without waste of valuable time. The movement of young people into the cities had already begun to cause some shortage of labour before this was increased by the outbreak of the war.

Cradling grain in the early 1860's: from a sketch made about 1865. The "binder" is using the method of raking and binding described in a letter of 1829.

CHAPTER 5

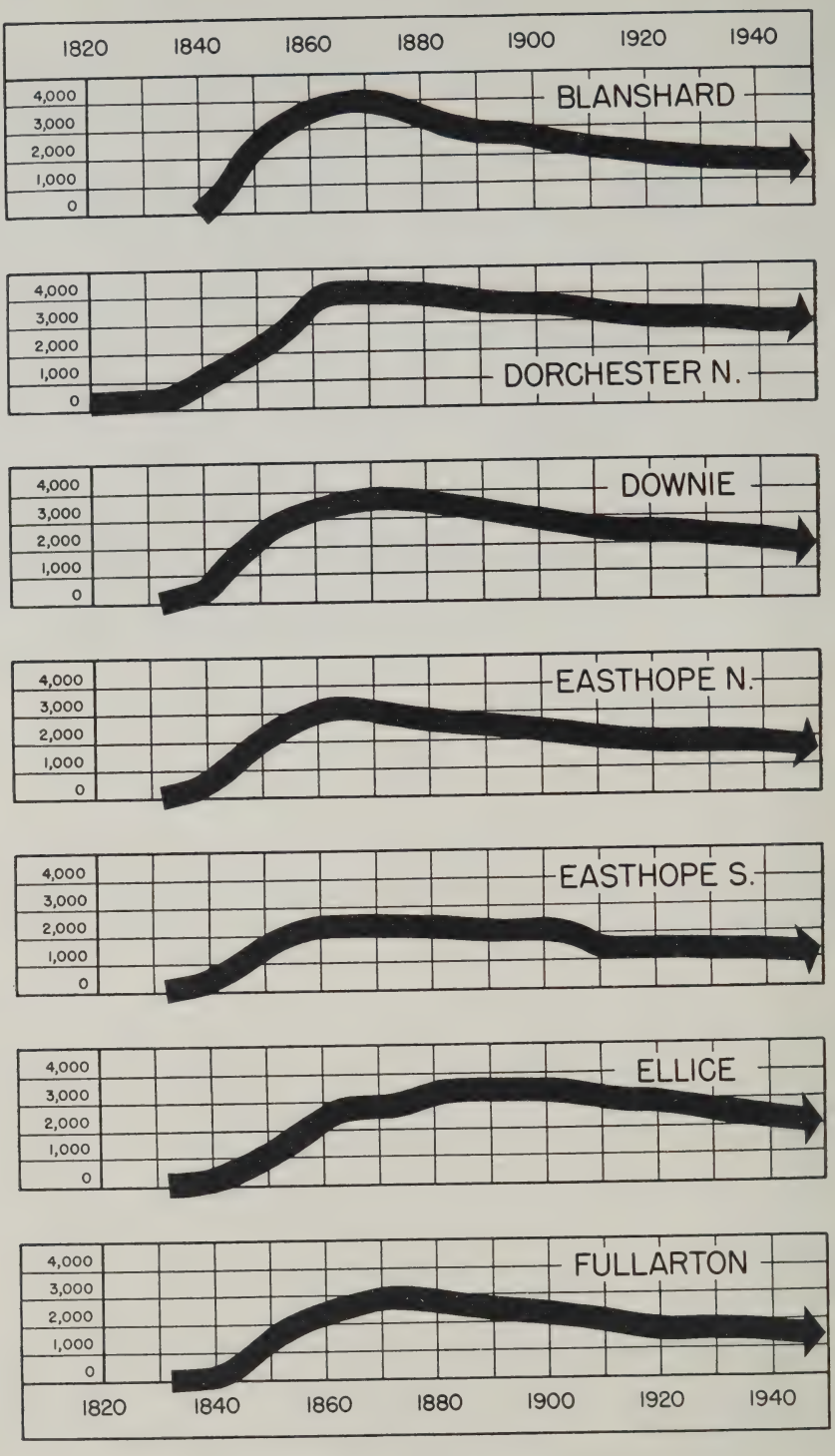
THE WATERSHED SINCE 1914

This period may be dealt with briefly, for the influence of wars and economic conditions was very much the same in the Upper Thames area as in other parts of the country and the events and their consequences will be well known to many readers.

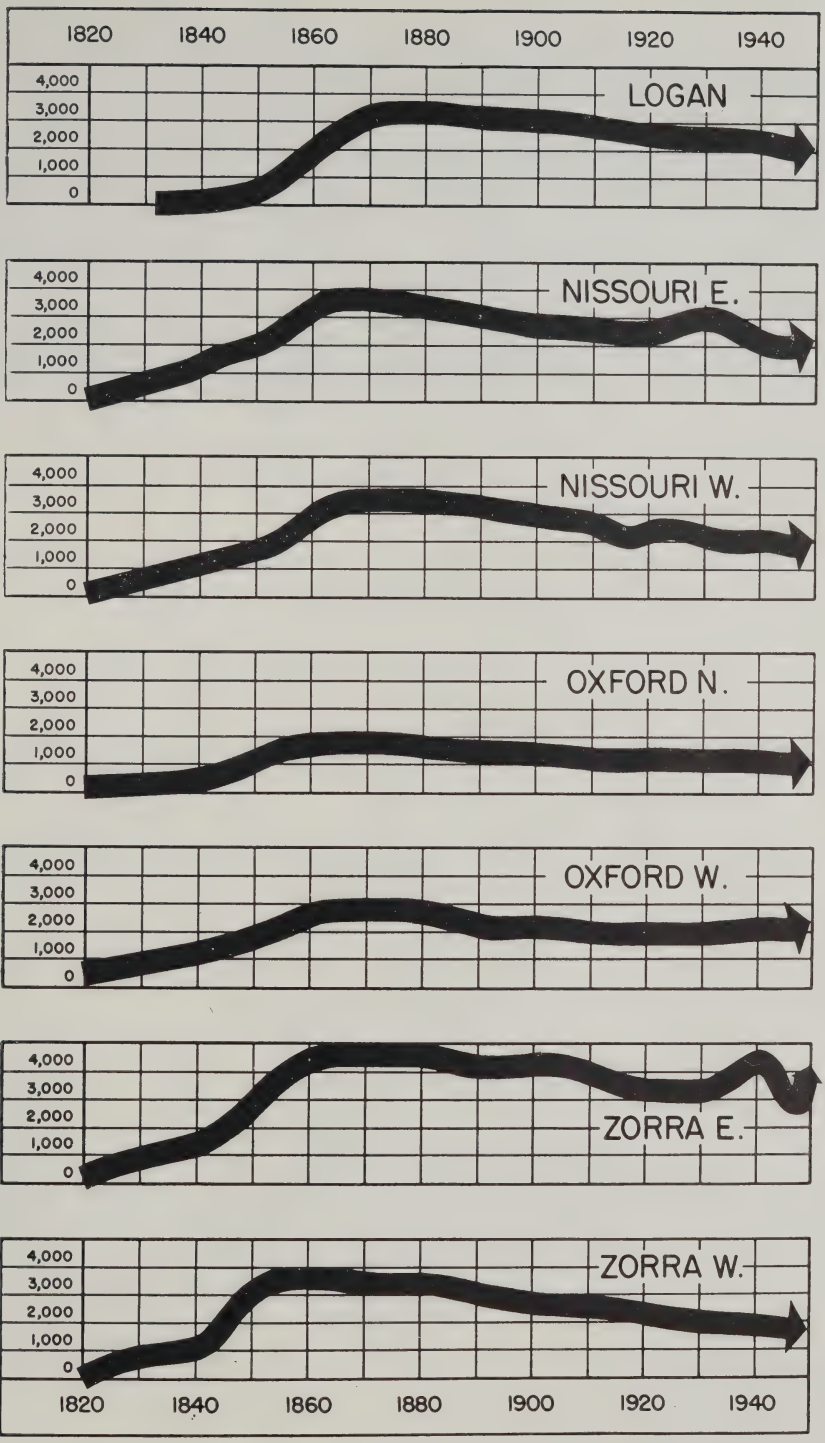
The inhabitants of the watershed played a full part in every kind of war service between 1914 and 1918. At home this involved a great increase in production in both industry and agriculture. In both the question of manpower was a difficulty, especially in the last two years. This perhaps was felt most severely by the farmers, who had less help than they needed when the war began and lost more to the cities in the first years as well as to the services.

War production introduced some new forms of industry. Some of these were abandoned when the need ended but others began developments that proved permanent. There was a great increase in the production of beef, pork and dairy products, especially cheese which had been made in much smaller quantity between 1911 and 1915.

The war was followed in the cities by a brief decline in business which soon gave place to a period of prosperity which came to an abrupt end in about eight years. Recovery in agriculture had been slower and production of all kinds was still low in 1921, but had improved considerably by 1931 when the full effects of the depression began to be felt on the farms.



TOWNSHIP POPULATION



TOWNSHIP POPULATION

The cities and towns were already suffering severely. Stratford had grown quickly after 1914 and during the years of expansion. It now began to lose population and had not made good the loss by 1941. Woodstock became a city in 1929. A return made at that time was much higher than the figures of population in either the 1931 or 1941 Census, so that this city may have been affected in a similar way to Stratford. In London there was much unemployment and the situation was still by no means good in the late 1930's. In fact there had been only a very gradual recovery before the beginning of the Second World War.

In the years between the wars, however, important changes were taking place which altered the life of the country and of the watershed. Motor traffic became much heavier during the First World War than before 1914 and grew constantly greater in the twenty years after 1919. A program of highway improvement was begun and had continually to be extended to meet the demands made upon it. By 1939 motor transport was competing with the railways and the motor car had replaced the buggy on the farms.

The development of motor traffic at first hastened the decline of the villages by allowing the larger places to be reached quickly and comfortably. But as traffic on the highways increased and tractors and trucks began to be more used on the farms, the demand for fuel and service sometimes caused a revival of business. The shift from horses to tractors and the spread of rural hydro would both have been quicker if conditions in the 1930's had been normal. Some further mechanization did take place and the acute shortage of farm labour that developed after the outbreak of the Second World War produced still more mechanization.

In the watershed, as in other parts of Ontario, this shortage of manpower made full production on the farms very difficult and even affected the price of farm property. Nevertheless a high rate of production was achieved during the war years. New types of cash crops were becoming important in some areas and the improved yields allowed a much greater production of the long-established types from smaller acreages than in the previous century. The production of milk was as great or greater than ever, but a smaller proportion was being used to make cheese. Even during the war, large quantities of butter were being made and exported in some parts of the area, while the production of concentrated milk and local sale of whole milk were growing greater.

The gradual reduction of the populations of most townships had probably been checked for a time after 1931. It had begun again ten years later, but returns made by the municipalities after 1948 suggested that the trend was changing in some cases, and this was confirmed by the figures of the 1951 census. Most townships now have greater populations than in 1941 and in the rest the losses have been comparatively unimportant. The motor car, electricity and the radio were making it possible to live comfortably in the country while working in a city or town at some distance. A comparison of these figures with the Land Use Map suggests, however, that more intensive use of the land was partly responsible for increased population in some townships. On the other hand, the expansion of the cities has not been so great since 1948 as was anticipated when making plans for future development.

Clarke's Bridge, London, 1843.

Wellington (Clarke's) Bridge and South Branch flats, London, 1945.

The need for careful planning both in town and country was being generally recognized in Ontario in the 1930's. Concern over flood damage, a lowered water table and reduced woodlands was producing a more active and general interest in conservation. It was soon realized that the problem extended beyond these particular aspects and concerned the preservation and improvement of all the resources of a wide area. The demand for public action in the Thames area had already produced some result before 1939. At that time the chief concern was the control of floods. But since a preliminary conservation survey was carried out under war conditions in 1945 and a Conservation Authority formed for the upper watershed two years later, more comprehensive plans have been made and have begun to be carried out.

In little more than two generations after settlement the Upper Thames Watershed had become what as a whole it remains today, a beautiful and productive area, prosperous and progressive. In achieving this the first inhabitants and their descendants did not often prove wiser or more disinterested than their contemporaries. The stock of knowledge which they could apply had been gained under different conditions of climate and soil. Though much was improved and much preserved, a great deal was used or wasted without thought of replacement. The signs of this wastage and hasty exploitation are not obvious everywhere in the watershed, but they can be plainly seen in some sections.

It is by the study of the record of the past in regions like this that the effects of the destruction of protective cover and water storage, of erosion, rapid run-off and pollution, have been realized and methods worked out for controlling them. Unless these are properly applied, even a fertile area like the Upper Thames may suffer serious damage that will affect its development and limit the prosperity of its inhabitants.

2

LAND

CHAPTER 1

GEOLOGY, PHYSIOGRAPHY AND CLIMATE

1. BEDROCK GEOLOGY

Underlying the soil materials at depths up to 230 feet or more is the bedrock of limestone and shale. The bedrock determines the altitude and general slope of the land and the nature of the soil. It is quarried in some places and it determines locations of engineering works built to control the river. Deep drilled wells may draw water from the rock but in many instances the water is too salty or sulphurous to use.

2. PHYSIOGRAPHY

The materials on the surface and the topography are the result of the continental glaciation which occurred thousands of years ago. The glaciers ground

up the rock and redeposited it as they advanced. As the glacier advance halted or the ice melted, certain types of deposits were made by the ice or the meltwater which issued from it.

The upland region of South-western Ontario was the first area freed of ice during the last glaciation. Meltwaters cut large drainage channels across the country. These are now occupied by much smaller streams.

Halts in the advance of ice are marked by "till moraines" made up of clayey or loamy materials. When materials were sorted by water the resulting land form, consisting of gravelly hills, is called a kame moraine.

The land form built under advancing ice is called a "till plain". There are two types. In the western and northern parts of the watershed the surface is irregular. In the eastern part there are long oval hills or ridges and flutings in the till plain, all running in the same general direction.

3. CLIMATE

The altitude and aspect of the slopes of the watershed give it higher rainfall and snowfall than the average for Southern Ontario. This fact is of special interest in consideration of floods and stream flow. The description is based on records over a long period at London, Stratford and Woodstock.

Winter temperatures on the upper Thames are similar to those of the Lake Huron and Lake Ontario shores, with a fairly marked difference, two degrees, between London and Stratford in the average for the winter months. Thus the snow blanket is deeper at Stratford. The lowest temperatures recorded are —27°F. at London and —31°F. at Stratford.

Plant growth begins around London about the second week in April, a week later at Stratford. Killing frosts may be expected in five out of ten years until May 13.

The yearly precipitation is about 38 inches at London and Stratford, which is five inches more than the average for Southern Ontario. The rainfall of the six summer months is 19 inches at Stratford and 18 inches at London.

Floods and soil erosion depend largely on the occurrence of unusually heavy or prolonged rains. In addition, the accumulation of precipitation in the form of snow and its rapid release in the form of water contributes to flood. The amount of rain needed to produce a flood cannot be stated definitely. The flood of April 24-26, 1937, resulted from a widespread rain of four to over five inches in 48 hours falling on an already sodden surface.

Records of heavy rains at the three stations mentioned above reveal a great deal. Heavy rains are not so frequent in March and April, which is fortunate. Falls of over three inches in 48 hours may be expected in one year out of five at London and once in two or three years at Stratford.

The number of rains of more than one inch in 48 hours was 156 in the 25-year period 1896-1920 and 163 for 1921-1945. Information of this sort is used in predicting future flood conditions.

The limstone bedrock which underlies the watershed determines the overall structure of the country and the nature of the soils. Quarry near Beachville.

The eastern portion of the watershed has many gentle ridges running north-west to south-east as in this scene south-east of Ingersoll.

Much of the watershed is flat but broken by irregularly hummocky slopes like this moraine south of London.

CHAPTER 1—A

PURPOSE AND METHODS OF THE SURVEY

The survey makes an inventory of land use and natural features of the land to appraise its capability and make recommendations for its future use and management. All physical conditions which control the use of the land, soil type, slope, erosion, etc., are observed and recorded.

The present land use is recorded to appraise its capability and determine its future use. The capability rating of each natural class of land is determined from its use and from the record of tests and experiments on similar soils. Using the record of land use, the extent to which land is being presently used according to its capabilities can be measured.

The actual use and management of the land is determined by the individual owner or operator. Any special practices for soil and water conservation will be applied by him. The operator is, nevertheless, part of a community and is influenced by many factors. The plan of recommended use is a guide to be followed by all those who have any interest in the productivity of the land.

In the course of the survey special attention was given to farm ponds, which are considered to be a very important phase of a conservation program. Also a small area on the Avon River was surveyed to show what could be done in detail as an example of watershed management.

The physical conditions of the land and the land use were examined on the ground and plotted on aerial photographs on the scale of 5.28 inches to the mile and drawn up on a map on the scale of one inch to the mile. Soil, physiography and geology maps were available for the area as well as a detailed study of erosion and land use on a small area made in 1945.

CHAPTER 2

SOILS OF THE WATERSHED

1. DEFINITION OF SOIL

Soil is the medium in which plants germinate, grow and from which they draw moisture and mineral nutrient. Soil is formed by the action of air, water and living organisms on the mineral material which mantles the earth.

2. THE GREAT SOIL GROUPS

The soils of the world differ chiefly in the effect of climate. The soils on the watershed have been formed in a cool moist climate under hardwood or mixed forest. The topsoil contains organic matter from decay of leaves and wood. Certain minerals and particles are leached from the topsoil by the downward movement of surplus moisture. The subsoil holds the accumulation of material from above and is usually a brown or reddish-brown colour due to iron compounds.

The chief differences in soil types within the area are due to differences in parent mineral material, which is the result of glacial action, and differences in movement of water due to surface topography and texture of the soil.

A soil is recognized and identified by examination of a vertical section, or profile. Within the profile are levels, or horizons, with different chemical and physical properties, such as colour, texture and consistency.

3. SOIL CLASSIFICATION

All the soils formed on one type of material belong to one "catena". Within the catena there may be recognized soils that are excessively, well, imperfectly and poorly drained.

4. SOIL SERIES AND TYPES

Within a catena soil "series" are identified, taking their names from the localities in which they were first identified. Within a series there may be "types" according to the texture, e.g., clay, clay loam, sandy loam, of the topsoil.

The following list of soil series and types have been identified and are shown on soil maps of Middlesex, Perth and Oxford Counties.

Soils developed on heavy-textured glacial till:

Well drained—

Huron clay loam — Huron silt loam

Imperfectly drained—

Perth clay loam — Perth silt loam

Poorly drained—

Brookston clay loam — Brookston silt loam

Soils developed on medium-textured glacial till:

Well drained—

Guelph loam

Imperfectly drained—

London loam

Poorly drained—

Parkhill loam

Soils developed on coarse-textured glacial till:

Well drained—

Dumfries loam — Dumfries sandy loam

Poorly drained—

Lyons loam

Soils developed on uniformly stratified sand:

Well drained—

Fox sandy loam

Imperfectly drained—

Brady sandy loam

Poorly drained—

Granby sand

Soils developed on stratified sands and gravels:

Well drained—
Burford gravelly loam
Imperfectly drained—
Brisbane loam
Poorly drained—
Gilford loam

Soils developed on stratified sand over clay:

Well drained—
Bookton sandy loam
Imperfectly drained—
Berrien sandy loam
Poorly drained—
Wauseon sandy loam.

CHAPTER 3

CAPABILITY CLASSIFICATION

1. DEFINITION OF THE CAPABILITY CLASSIFICATION*

Land classification according to its use capability is done so in terms of its physical characteristics. The classes are named according to the uses or systems of management that will give the best return from the land without deteriorating the land.

The classification described in this chapter is one developed by the Soil Conservation Service of the U.S. Department of Agriculture and adapted for use in this Province by the Conservation Branch of the Department of Planning and Development and by the farm planning group at the Ontario Agricultural College.

There are four main classes of land subdivided into eight use capability classes. They are summarized here.

A. Suitable for cultivation with:

I. No special practices;
II. Simple practices;
III. Intensive practices.

B. Suitable for occasional or limited cultivation with:

IV. Limited use and intensive practices.

C. Not suitable for cultivation but suitable for permanent vegetation with:

V. No special restrictions or special practices;
VI. Moderate restrictions in use;
VII. Severe restrictions in use.

*Classifying Land for Conservation Farming. Farmers' Bulletin No. 1853. U.S. Department of Agriculture.

A cut to show the profile of Guelph loam. Under the dark loam of the topsoil is a light gray level. The reddish brown subsoil is beside the shaft of the spade.

Dumfries loam. A coarse-textured permeable soil with a deep leached horizon (light gray beside the handle of the spade).

Tobacco is grown on the light, sandy soils of the Fox series.

D. Not suitable for cultivation, grazing or forestry:

VIII. Land may be of value for wildlife.

2. THE LAND USE CAPABILITY CLASSES

I. Land which is fertile, nearly level, not eroded, well drained, which can be farmed under ordinary good farm management without deteriorating.

II. Land whose inherent characteristics include some lack of fertility or organic matter, which is sloping and eroded or subject to erosion, or is naturally inadequately drained, which may be brought into a high state of production by overcoming fertility or humus deficiency, by checking erosion with simple practices, such as extended rotations or contour tillage, or which can be improved by simple artificial drainage.

III. Land of lower capability which can be sustained in production if protected from erosion by intensive erosion control practices, such as contour strips, diversion terraces; inadequately drained land which may be brought into full production by under-drainage; or land which can be used to only a limited extent because of shallowness, droughtiness, boulders, and so on.

IV. Land of low capability subject to erosion, which is difficult to cultivate, is inadequately drained or which is suitable only for a limited use, on which intensive soil-building practices and restrictions in use are necessary to maintain it in production.

V. Land which cannot ordinarily carry cultivated crops or a crop rotation but which can be maintained under sod or tree cover indefinitely without any special practices or any restrictions in its use. It usually includes bottom land and muck areas which cannot be drained.

VI. Land which cannot be tilled regularly because it is rough or is subject to erosion and cannot be exposed by regular cultivation, but which may be used for permanent improved pasture or for forestry.

VII. Land which must be maintained under sod or forest cover; and if sod, grazing should be controlled; and if under tree cover, planting on the contour, or when lumbered special methods followed to avoid wheel tracks and skid marks which might induce gullying.

VIII. This class includes very wet places, bouldery areas or outcrops of bedrock and gravel beds which may carry enough vegetation to offer a shelter for wildlife.

3. THE 1945 CONSERVATION SURVEY OF THE NORTH BRANCH CREEK AND TROUT CREEK OF THE UPPER THAMES WATERSHED

In this survey conducted by the Conservation Branch, more than 58,000 acres were examined in detail. The soil type was identified, 11 slope classes were identified and 5 grades of estimated erosion. At the same time the land use of each field was identified as cultivated, permanent pasture, woodland or idle. From comparisons of slope, erosion, natural drainage and soil type, the capability classification was derived. Herewith is the summary of the findings

Class I land on well drained Huron silt loam: stope under 2 per cent with no appreciable erosion. The crop is Winter Wheat with fodder corn on the right.

Class II land, suitable for contour ploughing, is subject to erosion when ploughed up and down the slope in this manner.

of that survey. First, it was found that soils of the Huron and Perth series are either flat or, if sloping, little more than 6 per cent slopes were found. Soils of the Guelph series were also mostly either flat or with slopes under 6 per cent, but some areas of irregular slopes up to 15 per cent occur. Soils of the Dumfries series are commonly found on rough, irregular slopes of 15 per cent. The less well drained series, Brookston, London and Parkhill and the Burford series were generally on level land. The incidence of erosion is summarized in the following table.

ACREAGE AND PERCENTAGE OF EACH EROSION GROUP

Erosion Group	Combined Acres	Area %
No apparent erosion	38,582	66.2
Slight erosion	11,926	20.5
Moderate erosion	7,216	12.4
Severe erosion	487	0.8
Gravel pits	31	0.05
Ponds	49	0.1
Entire project	58,291	100.00

Land use on the area was found to be 70 per cent crop land, 20 per cent pasture, 9 per cent woodland and the remaining area idle, covered by water or urban development. The Huron, the Perth, the Guelph and the London series had more than 80 per cent in crop land, which is 10 per cent higher than the average for the area. The highest percentages of woodland were on the Brookston soils, where they did not have artificially drained land, on the Dumfries soils and on muck and bottom land.

A fairly high proportion of slight and moderate erosion was found on the Guelph and Dumfries soils, which is to be expected as those are the two soil types found on sloping ground. A direct relation was found by comparing estimated erosion to slope classes. On land which had slopes under 6 per cent, only slight erosion was found, but on slopes between 6 and 15 per cent most of it was moderately eroded and only about a quarter of it just slightly eroded. On slopes over 15 per cent about three-quarters is moderately eroded and the rest severely eroded. The degree of erosion is a little less on soils on rough, irregular slopes, presumably because these had been cultivated less than the smooth slopes. On crop land there was found to be no erosion on 64.7 per cent, slightly less than the "no apparent erosion" for the whole area. Slight and moderate erosion on crop land was found on a slightly larger proportion than on the whole area. On pasture land moderate erosion was found on 17 per cent of the area, which is considerably higher than the average, and on woodland only 4 per cent was moderately eroded. It would appear that enough of the woodland had remained from the original stand of trees to cut down the amount of erosion, but the high proportion of moderate erosion on pasture land would appear to indicate that much of this land had been relegated to pasture because of erosion that had taken place in the past.

Flat and uneroded land of the well drained series was grouped in Class I. Slopes under 7 per cent which, as was shown above, did not have a high degree of erosion, were put into Class II. Slopes over 7 per cent were put into Class III land, as were the Perth and London (imperfectly drained soils). Class IV land included slopes up to 10 per cent if there was gullying, and up to 15 per cent if there were no gullies found. Bottom land and muck were allocated to Class V. Class VI land included slopes over 15 per cent if gullying or severe erosion were found, and slopes over 20 per cent. Gravel pits, sandy ridges which might be reforested were allocated to Class VII, and ponds were considered as Class VIII land. A multitude of classes of soil types and conditions, when thus grouped into eight classes, gave the following proportions: Class I—36.3 per cent; Class II—34.3 per cent; Class III—6.7 per cent; Class IV—11.4 per cent; Class V—7.5 per cent; Class VI—3.7 per cent; and insignificant proportions of Classes VII and VIII.

When the present use of the lands of the capability class is determined, two interesting features are apparent. First, the land of higher capability includes higher proportions of crop land and the land of low capability includes higher proportions of pasture and woodland, so that in general there is some adjustment of use to capability. The second feature is important in considering the future. There are still significant areas of land of low capability which are being used intensively for crop land. What is of further significance is that although much of the land of the low capability class, on account of drainage, is artificially drained, none of the land subject to erosion was being protected by any special tillage methods, and little of it being protected by any cropping systems designed to check erosion. The use of animal manure, limited use of green manure crops and a haphazard reliance on crop rotations were the only means of protection against erosion that were found.

4. RESULTS OF THE 1945 SURVEY

Although some of the soil types found on the whole of the Upper Thames Watershed do not occur in the sample area done in 1945, a good deal was learned about soils of the Guelph, Huron, Dumfries and Burford catenas. The increasing incidence of erosion with increasing slope, the intensive use of the less sloping and less eroded soils, the degree to which the use of the inadequately drained soils depended on artificial drainage, gives a basis for assigning different types of land to the use capability class, and in the survey carried out in 1950 land was allocated to a capability class directly in the field without reference to the more specific slope and erosion class. In this way it was possible to do a reconnaissance survey of the entire watershed, having previously examined a smaller part of it in detail.

Similar work was done by the Conservation Branch on the watershed of the Ausable River in the summer of 1947, and soil types found on the Thames Watershed, particularly the Berrien and Fox series, were examined in detail and capability classes assigned to them. Further, the problem of neglected pasture and compaction of clayey soils of the Huron catenas was studied. The importance of pasture improvement in bringing these soils into a more productive state

Class III land. This field has been exposed to erosion until more than two-thirds of the topsoil has been washed to the flats. Shallow gullies have commenced in the furrows.

Class IV land. Rill erosion, forming gullies as a result of ploughing up and down the slope. Note accumulation of the topsoil in the hollow

Class V land on the headwaters of Trout Creek is covered by a woodlot.

Class VI land on slopes from 25 to 35 per cent. This land was still being cultivated up to the spring of 1945. Erosion has progressed to the extent that much of the subsoil had been lost, as well as the topsoil. In the spring of 1946 the owner planted this area with trees

and making them less susceptible to erosion and accelerated run-off was studied so that again, on the reconnaissance survey, land could be allocated to a capability class from direct observation on the field.

CHAPTER 4

RECOMMENDED LAND USE ACCORDING TO USE CAPABILITY

1. CONDITIONS WHICH LOWER USE CAPABILITY

Certain conditions are generally recognized as lowering the use capability of soil—lack of fertility, inadequate drainage, droughtiness, stoniness and rough topography. Erosion, susceptibility to erosion, compaction, droughtiness resulting from erosion and lack of organic matter are not so generally recognized.

The capability classification described in the previous chapter is a "rating" of capability. The soils with lower ratings (II, III, IV and so on) have progressively poorer inherent capability or require more intensive practices (drainage, tillage methods for erosion control, extended rotations) to sustain them in production without deteriorating.

In this chapter there will be outlined a classification of "recommended" land use, according to use capability. In each class the recommended use is related to the condition which lowers its capability rating. This system avoids the numbering of classes and names them explicitly in terms of the recommended use.

2. EROSION, RUN-OFF AND SLOPE

The results of the detailed survey in 1945 showed how the degree of erosion increased with slope and how erosion affected land use. There is evidence of decreasing yields on eroded land which has lost its topsoil. Tests made on gently sloping plots of Huron soil near New Hamburg show how much soil and water is lost by erosion. These tests also show how much less is lost from land covered by sod or protected by contour tillage.

More serious, probably, than the loss of topsoil by erosion is the loss of water and the lower ability of eroded land to absorb and retain moisture. When land is kept under cultivation, particularly where furrows and drill rows run up and down hill, topsoil is eroded. The soil that remains cannot absorb rainfall so readily, thus run-off is increased and both erosion and accelerated run-off are aggravated.

If water is held by contour cultivation and soil organic matter built up, the soil is improved with respect to moisture absorption. For example, there is much less erosion and water loss on a cornfield when corn follows a soil-building crop than from corn following corn or other tilled crops.

Even though examination of a soil on a slope does not reveal any serious erosion in the past, there is always the possibility of erosion if it is found on similar slopes. Any method of checking erosion on land susceptible to it should increase the moisture-absorbing and holding capability of the soil and cut down on the hazard of drought.

The spring thaw washed out this small gully on a 3 per cent slope near Stratford.

A heavy summer rain did this damage in less than one hour on a farm near Stratford.

Long smooth slopes like the one in the background on No. 7 Highway near Rannoch are very subject to erosion but can be controlled by contour methods of cultivation.

3. IDENTIFYING AND ESTIMATING EROSION

Evidence of erosion is seen in "soil wash", "sand blowouts" and gullies. It is also seen in piling up of soil at a fence row and in the spotty catch of crop on droughty, eroded slopes.

Erosion can be identified and measured at any time by comparing the soil profile on a suspected location with that on a level, unexposed site. If horizons cannot be checked accurately there is a rough test that can be made. It is characteristic of these soils that no free lime carbonate is found except in the parent mineral material. The carbonates fizz with dilute hydrochloric acid and if this action is found closer to the surface than a normal profile depth, then erosion is evident.

4. INADEQUATE DRAINAGE

Soil may be inadequately drained because of poor surface drainage, seepage or high water table, or slow movement of water through heavy and impervious soil.

The ill effects of poor drainage are shortened cropping season, limitation of range of crops that can be grown, and difficulty in cultivation. Heavy wet soils lack good tilth and are often more seriously hurt by late summer drought. Poorly drained soils do not afford storage for heavy rains or melting snow.

Artificial drainage is brought about by digging ditches or enlarging the channels of streams. These measures carry away surface water and provide outlet for tile underdrainage systems.

5. COMPACTION

When the pore space between particles of soil, where air and moisture are held, is reduced the soil is said to be compacted. This may be a natural condition due to the formation of the soil or may be brought about in the use of the soil. Under cultivation the plough sole or trampling by cattle may compact the soil. The chief cause of compaction is probably the loss of organic matter.

Soils of the Huron and Perth series which are intrinsically very good may carry poor crops or very sparse weedy pasture. This is largely due to compaction. Another ill effect of compaction is a lower capacity to absorb and hold moisture so that erosion and water loss are aggravated.

Improved tillage methods, carefully chosen to remedy compaction, and use of manure and crop rotations, especially those which add organic matter and break up soil by root action, as with alfalfa and sweet clover, are the main remedies.

6. COVER CROPS

Crops to be ploughed under or left on fields over winter serve to build up fibre in the soil and provide a mechanical check to run-off.

7. PASTURE

Grassland management, including pasture improvement, is the greatest single erosion control and soil-building measure that can be adopted.

8. CONTOUR TILLAGE

On smooth slopes erosion and unnecessary loss of water can be checked by cultivating in such a way that rows run around the slope rather than up and down hill. This method can be combined with contour strip-cropping in which alternate strips of meadow and cultivated land are struck out across the slope, "on the level".

9. DIVERSION AND GRASSED WATERWAYS

Soil wash and fast run-off can be checked by breaking slopes with terraces. The terraces run along the slope and only slightly down hill to deliver water slowly and safely. They can be built using a plough.

Diversion terraces should lead water to a specially prepared grass waterway so that surplus water can run harmlessly downhill. Natural, intermittent watercourses should also be grassed. This not only conserves soil and water but makes better use of the watercourse by providing hay or grazing.

10. RECOMMENDED LAND USE ACCORDING TO ITS CAPABILITIES

The following classes of land are shown on the map accompanying the report:

L—Cultivated Land

Well drained, nearly level and uneroded soils of the Huron, Guelph, Fox and Burford series with no restrictions or special practices in their use.

LR—Restricted Cultivation

Level land on the Dumfries soil and land of other soil series which have irregular slopes susceptible to erosion, on which mechanical means of erosion control are not feasible but which can be protected by extending the rotation to include more soil-building and erosion-resisting crops.

CF—Contour Cultivation

Smooth slopes, up to 15 per cent, on well drained soils subject to erosion which can be protected by contour cultivation, strip-cropping or terraces.

LD—Drainable Land

Soils of the Perth, London, Brookston and Parkhill series may be drained, where suitable outlet is available, and thereby brought into a high state of production. Much of these soils has already been so treated.

In some locations these soils do not warrant the added cost of artificial drainage. In this case attention should be paid to using crops adapted to wet conditions.

ND—Not Drainable

The poorly drained soils associated with the Dumfries and Burford series are either too difficult to drain or no special advantage is gained by doing so.

P—Improved Pasture

Land subject to serious erosion or land which is too rough to cultivate, especially with powered equipment, should be kept under sod. Such land is more productive if the pasture is improved by cultivation, fertilizer and seeding. Improved stands of pasture protect soil from erosion and make more moisture go into the soil.

F—Woodlots and Reforestation

There is a great deal of seriously eroded, rough or very poorly drained land which would be better used if under tree cover. Large areas which might be required by the Authority for reforestation are indicated in the Forestry map. Smaller areas for improved woodland management or reforestation are indicated in the Recommended Land Use Map.

CHAPTER 5

PRESENT LAND USE

An inventory of the use of the land at the time of the survey was made in order to appraise the capabilities of the different types of land and to find what changes are necessary to adjust the use of all the land to its capability. Land covered to at least 40 per cent by trees is classed as forest. Where there is no cultivation, grazing or forest growth the land is classed as idle. Land which has been under sod for a period longer than any crop rotation is called pasture.

Cultivated land includes all land which is under regular crop rotation for grain, alfalfa, clover, hay, or pasture where it is ploughed under within three or four years. Row crops are those which are commonly called "hoe" crops or intertilled. They exhaust soil and expose it to erosion more seriously than other field crops or hay.

SUMMARY OF LAND USE

Use	Per Cent
Row Crops	6.9
Cultivated	62.6
Pasture	22.1
Forest	6.9
Idle and Urban	1.5

Roughly, the land is

70 per cent cultivated (in rotation)
22 per cent permanent pasture
7 per cent wooded.

CHAPTER 6

TYPES OF FARMS

A wide range of crops is found on the watershed. Poultry, sheep and hogs are raised, but the chief purpose of most of the farming is to carry milk herds or produce beef. The main difference in farms is in the type of herd. These were observed and recorded on a map.

Pasture, hay and grain with a herd of beef animals, on Huron and Perth soils near Kinkora.

The milk herd is the backbone of agriculture. This mixed herd is grazing on improved pasture on a clay soil in Blanshard Township.

Under good management high yields of oats and other grains are obtained, like this field on London loam near Zorra Station.

The obvious occurrence of such cash crops as flax, sugar beets, tobacco and truck crops, which are ordinarily sold off the farm, was noted and recorded on the map of farm types to indicate the areas where cash cropping is important.

Cash cropping may be beneficial in earning greater profits to be turned into farm and soil improvement. It may be harmful in exhausting the soil and exposing it to serious erosion, loss of water and risk of drought. When cash cropping is established on soils not suited to it, the practice may persist, to the detriment of that land.

The types of herds and incidence of cash cropping indicate six fairly distinct farming regions.

The north-west lobe of the watershed is part of a large area of beef production in Perth and Huron Counties. The soils are of the Huron and Perth series and there is little bold relief. There is some erosion on the slopes and obvious loss of fertility and tilth. Adaptation of grasses and legumes to inadequately drained and compacted soils with general emphasis on grassland management are the main conservation requirements. Dug-out farm ponds are needed for watering cattle.

The most westerly edge of the watershed is in beef production, but the country north of London is very mixed in use. Beef production, dairy production and cash cropping of sugar beets, wheat and barley are common. The soils are mostly of the London (inadequately drained) series. The run-off from this area contributes to floods in London.

Dairy herds and cash cropping on light-textured soils predominate in the Thamesford-London Plain while in the Oxford County Region most of the herds are for milk production for cheese manufacture. A wide range of crops is grown on the undulating, generally well drained, medium-textured soils. Erosion and drought evidence is easily seen and the country lends itself to all forms of erosion control.

Rough gravelly hills between Tavistock, Lakeside and Cobble Hill are covered by rather poor pasture used for both beef and dairy herds, and below London there is much cash cropping on sandy soils. Some of this exposes land to erosion.

Any plans for demonstrating and promoting soil conservation should be made taking into account the different types of farming and different types of land in each region.

TABLE A

PER CENT OF CAPABILITY CLASSES IN EACH PRESENT USE

Use Capability	Present Use					Totals
	R	L	P	F	X	
L	3.6	3.3	1.4	1.3	0.2	2.5
LR	31.3	30.6	20.4	11.7	16.2	26.9
CF	29.0	21.2	9.7	7.5	3.8	17.9
LD	30.7	35.2	30.5	22.1	12.6	32.7
ND	0.1	0.2	0.6	0.5	0.6	0.3
P	2.4	2.8	7.5	3.3	3.1	3.9
F	2.9	6.6	29.9	53.5	63.5	15.5
Totals	100.0	100.0	100.0	100.0	100.0	100.0

TABLE B

PER CENT OF PRESENT USE IN EACH CAPABILITY CLASS

Use Capability	Present Use					Totals
	R	L	P	F	X	
L	6.5	77.6	12.1	3.7	0.1	100
LR	8.0	71.3	16.8	3.0	0.9	100
CF	11.1	73.8	11.9	2.9	0.3	100
LD	6.3	67.3	21.2	4.6	0.6	100
ND	2.4	33.2	48.5	12.7	3.2	100
P	4.4	45.9	42.6	5.9	1.2	100
F	1.3	26.2	42.6	23.8	6.1	100
Totals	6.9	62.6	22.1	6.9	1.5	100

CHAPTER 7

THE ADJUSTMENT OF LAND USE TO USE CAPABILITY

1. THE USE CAPABILITY CLASSES

The question remains, is there enough land of high capability which, under the proper management, will carry cropland on 70 per cent of the area? The following table gives the answer.

L	Cultivable land	2.8%
LR	Restricted cultivation	26.9%
CF	Contour cultivation	17.9%
LD	Drainable land	32.7%
	Total	80.3%

The small percentage of land suitable for cultivation without special practices (L) presents no problem. Supposing, on LR land, that rotations were extended from 4 to 5 years, the proportion of grain is only lowered 20 per cent. Land suitable for contour cultivation (CF) can be retained in a 4-year rotation so that under proper management of erosion control there is no lessening of cultivated land. These three would then add up to 44.8 per cent which subtracted from 70 per cent leaves 25.2 per cent. This is only five-sixths of the land designated as drainable. Therefore, discounting that yields on sloping land subject to erosion should increase, and a sixth of the drainable land which might never be drained, there is still enough land suitable for cultivation to meet the demonstrated demands. This is a very encouraging answer. A further comparison of the present land use with the use capability should reveal the extent to which use is adjusted to capability and the extent to which use should be changed to conform to the natural characteristics of the soil. The two accompanying tables summarize these situations.

2. EXTENT TO WHICH USE IS ADJUSTED

The most extensive type of land is that which requires drainage. It is used for cultivated crops to about the same extent as the average for the area. Land recommended for pasture is actually less cultivated than the average. Examination of the tables of figures shows that there is a tendency for the lands of higher capability to be more extensively used.

3. DEGREE OF MALADJUSTMENT

Twelve per cent of the land suitable for continued cultivation is under permanent sod and 3.7 per cent is wooded. Granted that these proportions are small compared to the use over the whole area analyzed, it still means that some land of high capability is relegated to a lower use. That this is so is partly due to the rectangular layout of farms *and fields*. Rectangular woodlots and fenced pastures sometimes include areas of land of better capability which should be in neighbouring fields. Re-adjusting fence lines according to natural soil boundaries in most cases will correct this.

Of the land suitable for cultivation with restrictions and the land on which contour tillage should be practised, very little is wooded and only a small proportion pastured. The high proportion of these classes that are tilled can be maintained, but a good deal more attention could be paid to erosion and water loss control. The land suitable for cultivation with restrictions (LR) carries 20 per cent of the total pasture and the drainable land (LD) carries 30 per cent (Table A). The land designated as suitable only for pasture (P) is only 3.9 per cent of the whole area and it is obvious that demands for pasture far exceed this proportion. Therefore it can be concluded that lands of higher capability will carry some pasture. The drainable land can continue to carry a good deal of it and any further drainage projects should be carried out with this in mind. The LR land can meet demands for pasture and at the same time serve good conservation purposes if it is seeded to pasture with occasional cultivation. This can be achieved by very long rotations or what the British call "ley" farming. Some tests should be run to determine the longevity of pasture and proper methods of management so that the most can be made of this type of land.

There is forest cover on only 6.9 per cent of the land, yet 15.5 per cent of the land is really suitable only for forest. Quite a bit of land now under pasture or even cultivated should have forest established on it, either by plantation or by natural regeneration. Further, existing woodland should have grazing excluded from it. This would increase the demand for production from the existing pasture. There is no doubt that, if all the land now used or potentially useful for pasture were brought up to the standards of production of the best managed pastures in the area, the carrying capacity of pasture on the watershed would be increased many times. It is hard to say exactly how much; some demonstration pastures carry as much as four times what unimproved pastures carry, so that it is not too much to expect that pastures could be made to produce, on the average, twice as much as they have been producing. Thus, any loss of area of pasture because of forestry can more than amply be made up by increased production on pasture.

4. CAN USE BE ADJUSTED TO CAPABILITY?

From the foregoing discussion the answer to this question would appear to be yes. The problem is how to do it. This will be discussed more fully in the next chapter. Briefly, the solution lies in two kinds of actions. First is the planning of individual farms to make each field, the crops on it and the system of management fit the natural conditions of the soil. This is "Farm Planning". The second may be called "Regional Planning" and will be effectuated not by individual operators but by public bodies and businesses which determine public policy of land use in any way.

CHAPTER 8

A RECOMMENDED CONSERVATION PROGRAM

1. PURPOSE

The aim of a soil conservation program is to fit the use of every acre of land to its capability to produce without getting poorer.

2. DEMONSTRATIONS ON INDIVIDUAL FARMS

It is recommended that the Authority co-operate with existing agencies in establishing demonstration farms to show the application of farming methods designed specifically to control erosion and run-off.

Farms that have been planned for conservation now can be found on the watershed and the work on these farms is quite familiar to those who are interested in conservation and to a few others. It is now time to establish more of these farms so that every farmer on the watershed can see the same kind of operations.

It is recommended that demonstration farms be established according to the natural and economic regions outlined in Chapter 6 so that the farmers will see a demonstration on land which most nearly resembles their own with respect to soil conditions and type of farming.

3. FARM PLANNING AND CONSERVATION PRACTICES

To operate a farm most efficiently and to incorporate all the necessary features of soil conservation into its management, a plan is necessary. A farm planning service is provided from the Soils Department of the Ontario Agricultural College through the Extension Service of the Department of Agriculture. This technical assistance is obtained by farmers by application through their county Agricultural Representative.

A map of recommended use is drawn so that the existing fields, if necessary, are changed so that they conform to the natural conditions found on the farm. The use and the system of management of each field are indicated according to the natural classification. That is, for example, sloping land that is subject to erosion but on which erosion can be controlled by contour tillage and strip-cropping is marked out for cropping using those practices. Where seriously eroded land should be reforested, where gully control is necessary or where grassed waterways should be established are also indicated.

With the land that is available for cultivation under a crop rotation, particularly that on which strip-cropping is recommended, the system of rotation is worked out so that each year there is a constant acreage of grain and fodder to carry whatever herd it is found that the land can support.

On farms where there is mostly that type of land which is susceptible to erosion but it is not controllable by contour cultivation, there is not necessarily any reason to move fence lines or rearrange fields. A conservation system of farming calls for rotations to be worked out which will expose the land as little as possible to erosion and maintain the emphasis on soil-building crops. There may, however, be scope for certain individual remedies such as grassed waterways, or diversion terraces and buffer strips to break up the slopes. There may also be individual cases of gully stopping, reforestation, improved woodland management or pasture improvement which can be carried out on fields and farms as they stand now without any radical change in the farm set-up. These can be proceeded with directly by the farmer; but where it involves practices and methods with which he is not familiar he should avail himself of whatever technical assistance there is.

Most of the things that are considered to be "conservation farming" can be done by the farmer with his own equipment. There are some things, however, which may require special equipment or heavy implements that every farmer does not possess.

Actually, new methods are better learned by demonstration, and technical advice is available from the extension service carried on from the Agricultural College. Many of the implement manufacturers have handy bulletins on contour cultivation, terracing and pond construction and should be able to demonstrate the use of their equipment as they do at Grassland and Wheatland Days or as was done on the Heber Down Farm at Brooklin, Ontario, in 1949. A conservation field day comparable to a Grassland Day might be arranged to show off some of these methods.

A grass waterway in a field of grain near Fullarton is good farming practice and good erosion control.

On smooth slopes alternate strips cultivated "on the level" save soil and water. This is on a farm near Byron.

Improved stands of grass and legumes constitute the most effective tool in building soil, saving moisture and resisting erosion. They produce good milk and beef, too. This splendid example is on a farm south-east of Ingersoll.

4. GRASSLAND

The map of recommended land use according to use capability, which accompanies the Upper Thames report of 1952, shows the significance of the question of improved grassland. It might be said that this is the biggest single measure in soil conservation, whether it is considered from the point of view of area or of total production. The Grassland Day held at Woodstock in 1950 had as great significance to conservation as anything else that has ever been done.

Grass is both the biggest source of production of beef and milk and the surest way of building soil and resisting erosion. It might be said that if all the land on the watershed which is indicated as suitable for grassland, either in permanent pasture or in long rotations, were cultivated, fertilized and seeded to improved mixtures and were carefully managed with respect to clipping, fertilizing and grazing rotated, there would be more grasses and legumes produced than could be used for grazing and for making hay. An answer to this question is the use of grass and legume silage. Those who have gone over to this type of farming, especially on land particularly suited to grass, are wholehearted in their support of the practice. To those who have considered the economic problems of setting up a farm these days, particularly the administrators of the Veterans Land Act, the idea of wintering a herd on grass silage is very attractive. To all those who are advocating greater use of grass silage can be added those who are interested in soil and water conservation.

5. DRAINAGE

Over 30 per cent of the soil on the watershed is inadequately drained naturally for the production of the full range of crops used, particularly alfalfa and winter grains. A higher proportion of these soils is cultivated than the average. Obviously, much of the area has been artificially drained to some extent to make this use possible. As land use becomes intensified, as it is likely to be with the growth in population of the Province, further artificial drainage can be expected.

Opposition to drainage is based, it would seem, more on ill-advised, ill constructed and poorly managed drainage schemes than on any fault in drainage as an agricultural practice. In the procedure for carrying out drainage schemes there is no provision for even the advice of a soil expert or a trained agronomist. If proposed drainage schemes were reviewed from the point of view of whether the soil needed it or whether they were required for the cropping schemes on the land the decision to drain would be better supported.* The thousands of acres in Ontario which now carry willow scrub or poor wetland pasture with old but expensive drainage ditches going through them are mute evidence of the inadvisability of many drainage schemes. An anomaly in the administration of the drainage laws is often seen in awards on the basis of the land drained by the ditch regardless of whether the soil actually benefits from artificial drainage. Indeed, cases might be cited of the presumed beneficiary suffering from loss of water.

Under present legislation the Conservation Authority is at least aware of what is proposed and can make it its business to study these other implications and use whatever influence and powers it has to inform and guide public policy in the matter.

*Report of the Select Committee on Conservation. Ontario, The King's Printer, 1950.

It is ironic that areas which are drained artificially may suffer from drought in summer and even have a shortage of water supplies. If drainage were considered as "redistributing" water, and provision were made to hold part of the surplus flow for later use, rather than merely a process of "getting rid of the water", artificial drainage would appear in a better light.

6. LAND USE POLICY

Although the farmer is considered as the one who determines what use is made of the land and how it is to be managed, a little reflection will show that land use is actually controlled by many other people. The three main groups which influence land use are the agencies that extend credit to the farmer for his property, his improvements and his operations; the firms that supply him with his equipment, seed, fertilizer and materials; and the marketing agencies which buy his produce. A further control is in the governments which tax him and which, by systems of tax concessions and marketing aids, can induce him to apply his land to certain uses.

All these groups are as much interested, if not more, in sustaining not only the productivity of the land but the welfare of the whole community of which the farm is a part. It is conceivable, then, that without compulsion or control land use can be planned in such a way as to protect the soil and water, in short, to achieve the aims of conservation, "the wise use of all the land, for all people, for all time".

For the most effective action in planning land use there must be some central agency whose interests cover all phases of land use to co-ordinate the gathering and dissemination of knowledge and the framing of policy. No body could perform this function better than a Conservation Authority and they now have the machinery for doing so in their Advisory Boards. It is therefore recommended that the Authority facilitate conferences of representatives of producers, financial houses, supply businesses and marketing agencies of agricultural produce within the watershed to discuss ways of shaping land use in accordance with conservation principles and what is known of the physical characteristics of soil and water resources.

7. CREDIT AND LAND TENURE

That the soil has been required to produce more than it can safely yield from year to year is not necessarily the fault of the farmer or of those who have been before him on the land. Whether owner or tenant, the operator has certain financial commitments to meet from year to year. To remain in possession and in operation he must meet these and he must use his land in such a way as to yield the necessary cash return. This is the reason for a good deal of the erosion and soil depletion which has gone on in the past. In the United States, where the problem of soil erosion and depletion and drought has been dealt with systematically for some years, this is recognized. Steps to correct it have been taken, not only by governmental bodies but by financial houses, in so far as their system of banking allows the extension of credit on land. The American attack on the problem merits close study. It need not be necessary to adopt their financial machinery nor revise our own to meet the situation. What is

required is to study how our system of land tenure and financing can be accommodated to take into account conservation of our resources as much as they do prices, markets and all the other factors which influence the money market. It is recommended, therefore, that the Authority, through its Forestry and Land Use Advisory Boards, bring the inventory of resources that is given in this report and its maps to the attention of those who have a financial interest in the sustained productivity of the land.

With respect to cash cropping which may erode land and aggravate soil problems, the only direct action the Authority can take is to acquire land for reforestation. The only other way in which harmful cash cropping, particularly tobacco, could be excluded from water-storage areas in swamps and from land susceptible to erosion is by passing zoning by-laws for areas to be protected. This need not conflict with the interests of producers, for there is ample land that is not vulnerable to satisfy foreseeable demands for special types of soil.

8. FORESTRY AND RECREATION

Acquisition by the Authority of land for these uses is described in other sections of the report. There is, however, a large acreage of land suitable for tree plantations or for woodland improvement remaining on farms. The Authority can assist farmers in reforestation and might enter into co-operative management of existing woodland, extending to the operator, not only technical assistance, but some material help in fencing and in arranging orderly and profitable marketing of his wood products.

CHAPTER 9

FARM PONDS

1. INVENTORY OF PONDS

On the basis of what was actually found on the watershed and comparing this information with what is known of the types of land, a map of "Recommended Regions" was prepared. On this are indicated the regions most suitable for each type of pond.

Ponds that are actually being used on farms are of five types. These are: natural ponds, dug-out ponds, spring-fed ponds, by-pass ponds and ponds formed by dams. They have a variety of uses. Fire protection and stock watering are the main uses, but fishing, swimming and irrigation are not uncommon uses and some have been built for property beautification.

Of the 216 ponds examined on the watershed, 62 were natural ponds, 139 dug-outs, 8 spring-fed, 1 by-pass and 6 formed by dams.

2. RELATION BETWEEN EXISTING PONDS AND LAND TYPES

It is obvious that certain types of land are particularly well suited to ponds of certain kinds. Where ponds are lacking it is difficult to say whether it is because no need has been found for ponds or whether the land has not been suitable.

Dug-out ponds like this one near Elginfield are common in areas with ground water near the surface.

A well-managed spring-fed pond north-east of Stratford.

A run-off pond under construction north of Beachville. Note the clay dam to the right, emergency spillway in the background and drop inlet discharge pipe in the middle.

The commonest type of pond is the simple dug-out, and these are found especially on two types of land. First, the wetter locations on the undrumlinized till plain. Second, the clay moraines which have irregular topography and numerous wet hollows. Natural ponds are found in the same locations and also on the flat valley bottoms or spillways where water lies in pools or can be found easily by simple excavation.

Ponds that require definite construction only totalled fifteen, and only one was found on the drumlinized till plain. This is remarkable because it is on this type of land that the most prosperous agriculture is to be found. It would appear that up to the present no particular need for ponds has been felt, but it would seem that this type of land would lend itself particularly to pond building by damming watercourses. The soil on this land type is fairly permeable and in the past farmers may have found that ponds do not readily hold water, but on similar situations on other watersheds, possibly where people are more "pond conscious", ponds have been found.

The commonest type of artificial pond is that which is fed from springs. These are not found on the kame moraines, probably because the soils are too permeable, and only one was found in a spillway. These permeable soils often have springs along the margin, between them and the less permeable soils.

A very useful type of pond, because it is so simple to build and has such a small risk of being washed out or silted in, is the by-pass pond, but only one of these was found. There are six ponds formed by damming, mostly on permanent streams, although they can be built on intermittent watercourses where they are certain to be filled during the spring run-off and on many occasions may be re-filled during summer storms.

3. RECOMMENDED REGIONS

Providing a suitable impermeable bottom can be found, the drumlinized till plain should be able to carry any type, according to the available supply of water. The type of pond called the "run-off", which is not listed here but which is commonly referred to in literature on ponds, might be established by putting earth dams across intermittent watercourses which drain sufficient land to give the necessary run-off.

On the undrumlinized till plain in the north-western part of the watershed, the commonest type is the dugout pond; and although other types might be built, and there is no question regarding permeability of the soil, the dug-out type should be the commonest.

In the regions of till moraine all types might be built, but special attention might be paid to the run-off types as the country is generally rolling and provides many suitable small watersheds to feed ponds by surface run-off.

The kame moraines and sand plains are considered less suitable for ponds because the soil is so permeable that the pond may not hold water nor an earth dam be entirely reliable.

On the flat valley bottoms and plains indicated as spillways on the physiographic map, ponds are less certain of success. This is because the gravelly

A good example of a temporary dam on the Rouge River. This is removed each autumn, permitting the spring run-off to come down uninterrupted.

and silty soils are so permeable to water. Small streams might be drained or excavations at the side may be made for by-pass streams, but if this is contemplated investigation must be made to establish that there is an impermeable clay bottom on which the pond may be sited. For this purpose an extendible soil auger which will bring up samples from ten feet can be used.

4. BUILDING FARM PONDS

A farm pond might be defined as a surface reservoir of water with a natural supply to be used for farm purposes and to cost no more than what a farmer would be prepared to pay for either a main or supplementary (or emergency) supply of water.

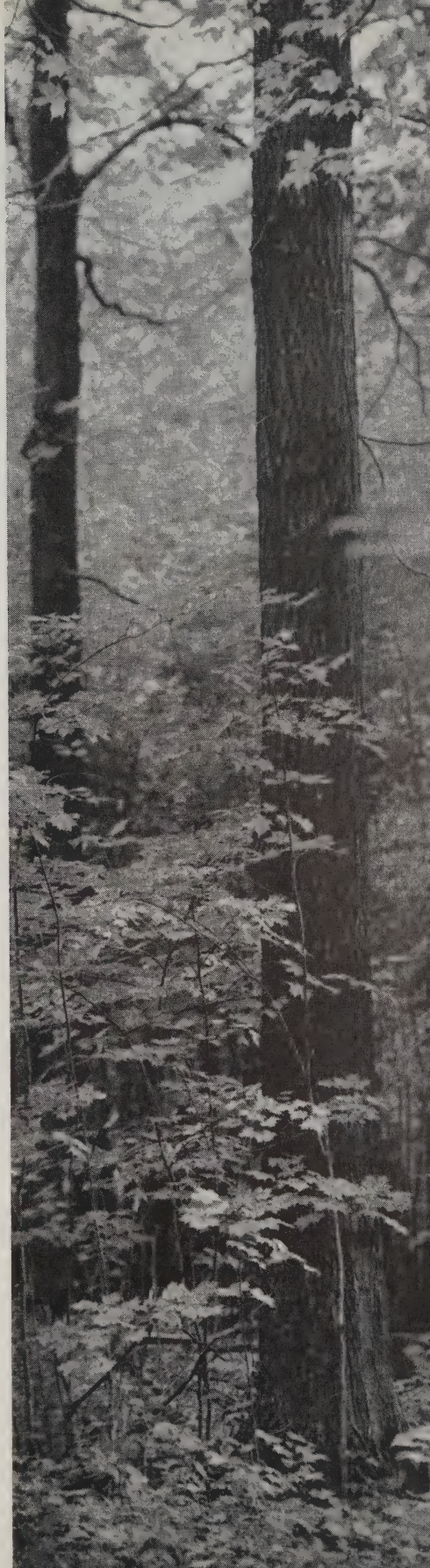
Farm ponds have two purposes—first is to serve the farmer on whose property they are built. The second purpose is only achieved if a great many ponds are built. That is, it is believed that a multitude of small ponds will help to conserve moisture in the soil and, in the case of ponds formed by dams, help, each in their small way, to control the flow in the streams.

A bulletin describing the main features of pond building is available from the Conservation Authority. This is only a guide and does not presume to give specific instructions for each individual pond. This pamphlet, and the information given in the Thames report of 1952 should be helpful in a general way; but actually selecting the site and constructing the pond should be undertaken only under the direction of a person competent to make the decision. As pond building becomes more common, farmers and contractors should become more familiar with the details of constructing ponds in each locality.

Because ponds are of value to the whole watershed as well as to the individual farmers, it seems only right that a program of pond building should have the support of the Conservation Authority, and the program is getting that support in provision of some technical help in constructing ponds. It is recommended that the Authority continue to carry out this project.

3

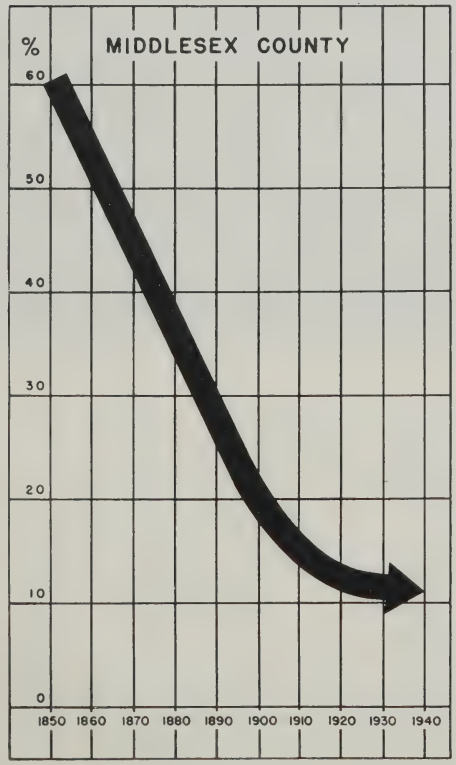
FOREST

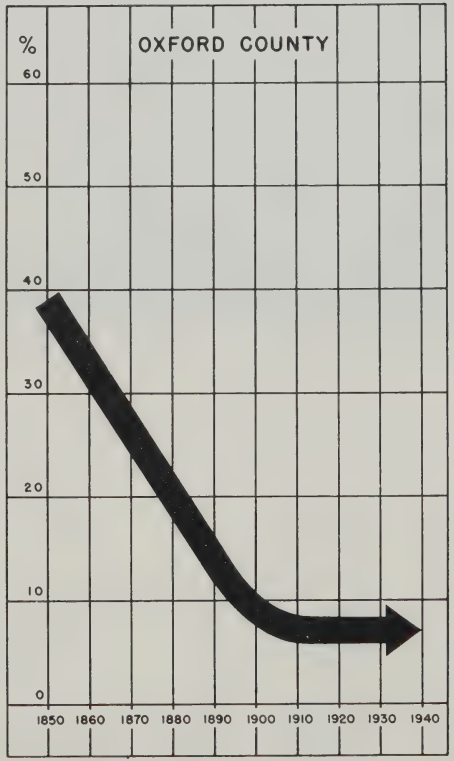


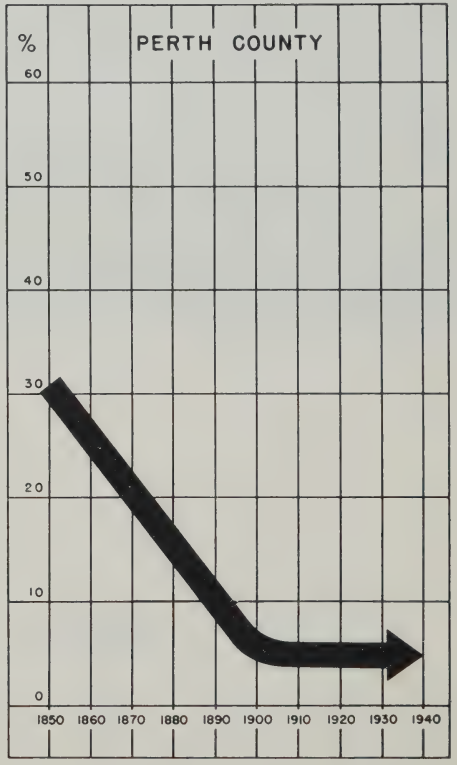
CHAPTER 1

THE FOREST

A dense forest of great hardwood trees covered most of the Thames Watershed in its original state. Sugar maple and beech were the main species over most of the area, though the north end, particularly Ellice and Logan Townships, constituted part of a very extensive hardwood swamp comprising silver maple and white elm trees in the main. The southern edge of the watershed from Ingersoll west to Delaware, especially on the lighter soils, was covered with oak, walnut, hickory, black cherry and numerous other southern hardwood species. Pine and other coniferous species were scarce and in 1824 it was stated that "there are not more pine and cedars than suffice for building materials and for home consumption".







PER CENT WOODLAND

CENSUS OF CANADA FIGURES

The suitability of the greater part of the Thames Watershed for cultivation and the inimical attitude of the settlers to the forest led to a very rapid depletion of the woods. The swing of the pendulum carried the clearing of them past the bounds of economic necessity and past the point which would have left the minimum area of woodland required to protect the water economy of the area.

Although settlement did not begin until the early part of the nineteenth century and the forest was almost unbroken along the Governor's Road for miles west of Woodstock as late as 1837, so rapid was the reduction of the forests that by 1860 the forests of Middlesex and Oxford were depleted by more than 60 per cent, by 1910 by more than 90 per cent, and by 1940 the Census of Canada showed woodland on occupied farm land to be 7.8 per cent in Middlesex, 6.7 per cent in Oxford and 6.1 per cent in Perth. The actual measurement of woodland made in the survey of 1950 shows a total of 57,025 acres or 6.7 per cent of the area of the Upper Thames Watershed.

CHAPTER 2

FOREST PRODUCTS

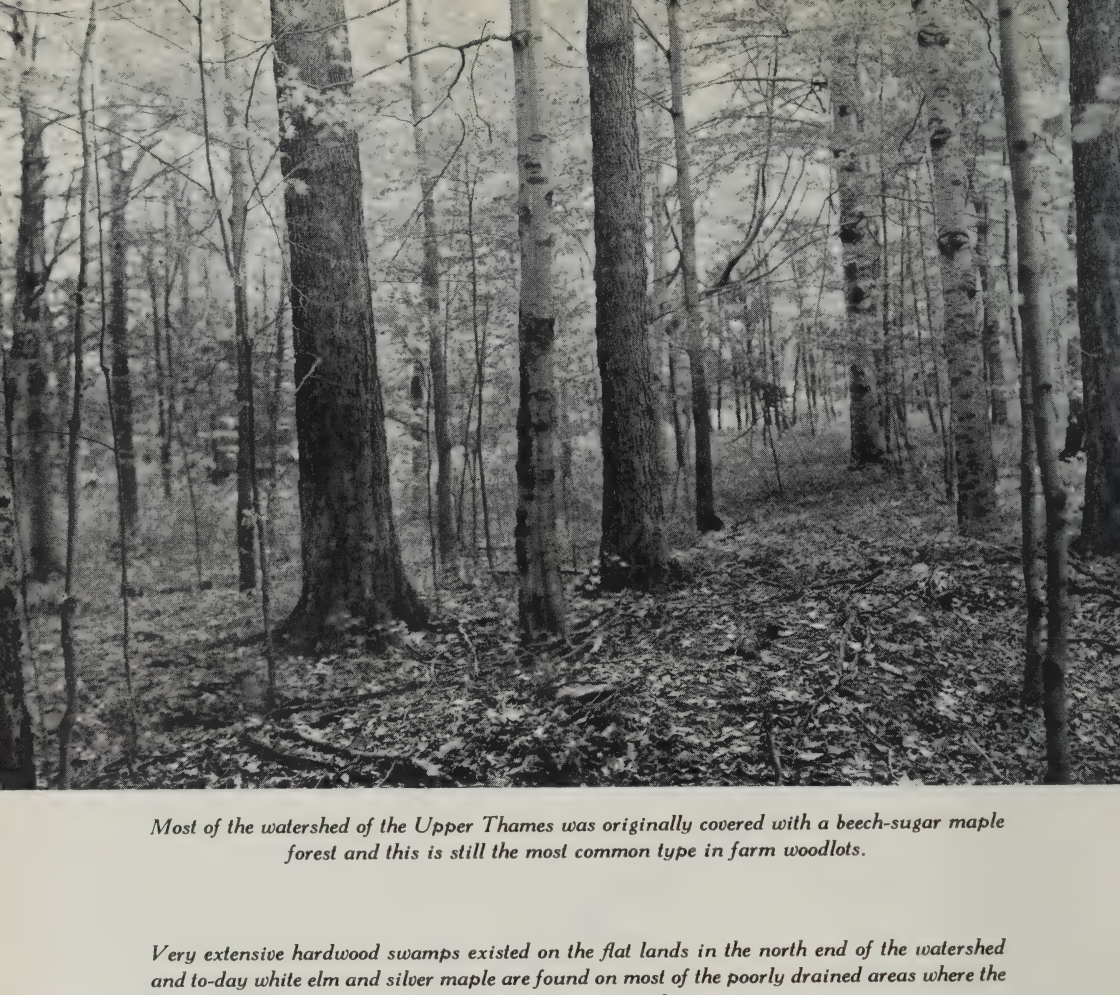
Two factors served to make the pattern of lumbering on the Thames Watershed somewhat different from that on watersheds further east. First, the timber was predominantly hardwood. Secondly, it had to travel westward down the Thames and then eastward through the Great Lakes. Consequently not a great deal was exported to Britain though considerable quantities went to the United States. Also the building of boats for the lakes' trade early became a thriving business, notably at Chatham, and this absorbed a great deal of timber.

Until 1826 the timber on the public lands was reserved for the Royal Navy and could not be cut without licence. There was a considerable illicit trade, but the restrictions were a source of annoyance to the people and authorities of the colony. A system was set up by which anyone was at liberty to cut timber on the ungranted crown lands of the Ottawa region by paying a fixed scale of fees.

Mast timber was marked by government agents with a broad arrow blaze. As late as 1827 the Surveyor-General was ordered to make a survey of "Masting and other timber fit for the use of His Majesty's Navy". The mast and spar export to Britain throve in the 30's and 40's and continued intermittently up to 1855. The British trade dropped off noticeably after the Reciprocity Treaty with the United States in 1854, and after the building of railway connections with United States cities.

Squared timber at first consisted mostly of white pine, squared on all four sides into one long stick. Later walnut, oak, ash, birch, elm, maple and even hemlock were made into squared timber.

In the very early days of settlement sawn lumber was prepared by hand-sawing in a saw-pit or with a platform on which the "top-sawyer" stood while his mate stood below the log. Twenty-five boards was a heavy day's work for two men.



Most of the watershed of the Upper Thames was originally covered with a beech-sugar maple forest and this is still the most common type in farm woodlots.

Very extensive hardwood swamps existed on the flat lands in the north end of the watershed and to-day white elm and silver maple are found on most of the poorly drained areas where the woods have survived.

A study of the Census of Canada forest products returns reveals the various changes in the lumber industry. From 1870 to 1890 much of the timber was squared and measured in cubic feet. In 1870 other products listed were firewood, staves, lathwood, tanbark, and masts and spars. In 1880 the peak production of nearly all items was reached and squared elm alone in Perth County and squared oak in Middlesex ran to almost 174,000 and 481,800 cubic feet respectively. In 1890 fence posts and telephone poles were added to the list of products, as were railway ties. In the census years of 1900 and 1910 square timber was still recorded in cubic feet and logs were measured in board feet; staves, lathwood, masts and spars and tanbark disappeared from production.

In 1920 no square timber is shown, logs are only counted, not measured, and not even separated by species. The returns of the latest census covering the year 1940 name only one forest product and the rest are all listed together as "others" valued at so many dollars. The one product which has persisted throughout the records is firewood, which in Middlesex County has dropped from a peak of 267,756 cords in 1880 to 47,230 cords in 1940.

One or two interesting observations with regard to individual species may also be made. Tamarack was listed regularly until 1890, after which it no longer appears due to the depredation of the larch saw-fly which almost wiped it out at this time. The returns show that some black walnut and hickory were cut in all counties each year until 1880. White pine was, of course, the species most sought after, though not much existed in the counties of the watershed, and next to it red pine of which a little was present in all counties. In 1870 and 1880 elm and oak were the main species which were squared, but as these species became scarce more ash, birch, and maple were made into square timber.

Wood was the sole source of fuel until 1850. With the introduction of steam power the forests of the area were ruthlessly cut to supply fuel for engines. Steamboats used fifty or sixty cords between Toronto and Montreal. For some time after 1856 the railways burned large quantities of the best body hardwood, chiefly beech and maple.

A great quantity of wood was consumed in building bridges and roads, both the early log "corduroy" roads and the later plank roads. Much cedar and some other wood was used for rail fencing, though pine stumps or stone sometimes took the place of rails. About 1900 wire fencing came into use and a fence-post industry developed.

Woodworking and planing mills were introduced into the watershed in a later stage of settlement. At first all the trim for buildings and the sash, doors and "blinds" (shutters) were made on the job by the carpenter, and even boards were planed by hand. Later, water-driven "planing and turning machines" were introduced and with the increased use of steam power, power planing and turning mills became more common and "sash, door and blind factories" were set up in some places.

Wooden implements and vehicles required special woods for the different types. Hickory was preferred for axe-helves, beech for the beams of ox-yokes

and ironwood for the loop or "bow." Spike handles were made of rock elm, white ash, hickory or ironwood. Vehicles were first made by the farmers themselves, later by carriage- and wagon-makers in the villages. A good deal of selected rock elm, white ash, hickory and ironwood was used for this purpose. Factories finally replaced the single craftsman or small shops in those types of woodworking.

The three most important indirect products were maple sugar, potash and tanbark. Maple sugar was almost the only sugar available to the pioneers, but in 1910 the Census records begin to list maple syrup as well, indicating the change from a pioneer necessity to a modern luxury. The production of sugar and syrup in all three counties in 1940 was less than 3 per cent of the output in 1860. Potash was extracted from the ashes of hardwood trees (60 large maple trees produced one barrel of 650 pounds) and shipped to Britain for use in the dyeing industry. Tanbark came from oak and hemlock trees and was used in tanning leather. Most of that produced in the Thames area was probably oak tanbark.

CHAPTER 3

PRESENT WOODLAND CONDITIONS

In order to get an accurate picture of woodland conditions in the watershed, a detailed study was made of all woodlands, natural water-storage areas and plantable land. Every area of woodland, marsh, swamp or other wasteland was visited and studied. Where doubt existed whether an area should be classified as woodland or not, woodland was given the benefit of the doubt.

All woodlots were grouped according to the Department of Lands and Forests classification in which the term hardwood is used for all broad-leaved trees and coniferous for needle-leaved trees. A stand in which neither hardwoods nor conifers predominate is classed as a mixed stand. Stands were also grouped according to the degree of maturity, cutting and forest cover type. Records were made of planting, care, damage and survival of all plantations.

There are 57,025 acres of woodland within the watershed or 6.7 per cent of the total area of 847,949 acres. Separate woodlots examined numbered 7,279. In many cases, differences in type and age made it necessary to list large single wooded areas as several woodlots, while other wooded areas, extending over several properties without boundary marks, were sufficiently uniform to be classed as one woodlot.

The conifers occurring in the watershed are white pine, hemlock, white cedar, tamarack and black spruce. Red pine occurred in the original forest but no trees were found in the natural state at the time the survey was made. White pine is fairly generally scattered throughout the moraine areas, especially in the south-east. Hemlock is found mixed with hardwoods, and white cedar and tamarack are present in the small swamps. Black spruce is very rare, but was found in one small muskeg, an island of Boreal vegetation, near the London Sanitarium. Conversely there is an outlier of the Deciduous Forest near Lakeside where chestnut grew in considerable abundance before its decimation by the Chinese Chestnut Blight. There is no doubt that conifers formed a larger

White elm and silver maple occur on poorly drained soil which is frequently heavy clay. Cattle not only destroy the young growth and forest floor but puddle and compact the soil.

Before regeneration can be obtained here, it will be necessary to cultivate the soil well in May before the trees seed in June. The trees have become "stag-headed" from the compaction of the soil.

part of the woodland than they do today, but their numbers have been diminished because of the desirability of the lumber they furnish, and recurrent fires have destroyed them while more fire-resistant species such as oak have survived. The situation at the present time is that of the 57,025 acres of woodland, 93 per cent is classified as pure hardwoods, 4 per cent as mixed woods and 3 per cent as pure conifers. In the 93 per cent classified as hardwoods 5 per cent is over 18 inches in diameter at breast height, 36 per cent is 10 to 18 inches, 35 per cent is 4 to 10 inches and 16 per cent is young growth under 4 inches in diameter at breast height.

In the mixed wood classes, comprising 4 per cent of the woodland, 1 per cent is 10 to 18 inches in diameter at breast height, 3 per cent is 4 inches to 10 inches, while less than 1 per cent is young growth under 4 inches. In the coniferous woods 2 per cent is second growth, 4 to 10 inches at breast height, and less than 1 per cent is young growth under 4 inches.

For the whole area the percentage of uneven-aged stands is somewhat more than the even-aged, the figures being 53 per cent of the former and 47 per cent of the latter.

Grazing in farm woodlots is still fairly general, the percentage of grazed woodland being 50 per cent for the whole watershed. The percentage of grazed woodlots is low compared with other watersheds.

To sum up, 95 per cent of the woods are second growth with a mixture of large trees in many areas, and of these 16 per cent are young growth, the former ranging from 30 to 50 feet in height. The woodlots containing the largest trees are composed of old hardwoods, elm and soft maple in the swamp areas and sugar maple, beech and basswood on dry sites.

CHAPTER 4

CONSERVATION MEASURES IN PROGRESS

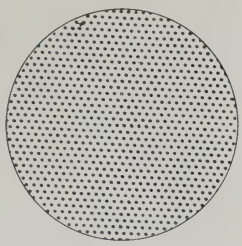
Very little sand land exists on the watershed so that no plantations are very extensive.

1. PRIVATE PLANTING

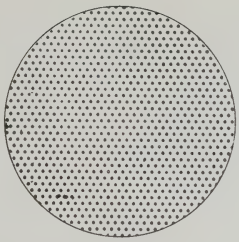
Free distribution of trees for planting was first begun in Ontario in 1905, and the following year a statute was passed which permitted a township council to exempt a part of the woodland of a farm from taxation; it provided that exemption be extended to any part of a farm used for forestry purposes or being "Woodlands"; provided that such exemption shall not be greater than one acre in ten acres of such farm and not more than twenty acres held under a single ownership.

In 1927 the exemption of taxation on woodland was made compulsory if applied for, and is interpreted as meaning planted as well as natural trees.

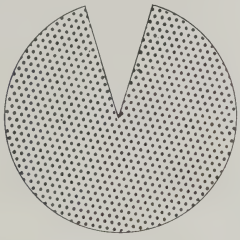
In 1938 The Assessment Act was amended to prevent the assessment being raised on land after it had been reforested.



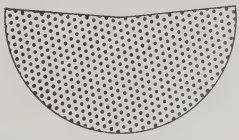
TOTAL
849,949 acres
(100%)



TOTAL
37,500 acres
(100%)

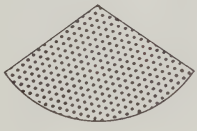


OPEN
771,776 acres
(90.8%)



OPEN
19,692 acres
(52.5%)

WOODLAND
57,025 acres
(6.7%)



WOODLAND
11,797 acres
(31.4%)

SCRUB
20,867 acres
(2.5%)

SCRUB
5,730 acres
(15.3%)

BOG
281 acres
(0.0%)

BOG
281 acres
(0.8%)

TOTAL WATERSHED

AUTHORITY FOREST
INCLUDING LAND ALREADY ACQUIRED

LAND CLASSIFICATION

Both these Acts were designed to facilitate the planting of trees on private land and should be taken advantage of by citizens anxious to improve woodland conditions on their own property and at the same time benefit the whole community of the river valley.

Within the Thames Watershed there are 272 private plantations, most of which are small, namely two to twenty acres in area. The largest are those of Dr. R. S. Murray in Downie Township, which cover 120 acres.

The total acreage of private plantations of over one acre in extent existing today is 1,034.

2. COUNTY FORESTS

The present policy of county forests was laid down in 1922, and is carried on under The Trees Act. Under this Act a municipality may purchase land for reforestation and enter into agreements for its management without any limit as to size. The agreements now in force run for thirty years, the Ontario Government agreeing to establish the forest and pay all the cost of management during that time.

Under the amended Act, townships have the same powers as counties, excepting that of issuing debentures. They may levy, by special rate, a sum not exceeding $1,000 in any year, for reforestation purposes.

The agreements which have been drawn up between the river valley Conservation Authorities and the Ontario Government to establish and manage the Authority forests is substantially the same as that made with the counties except that the government has agreed to pay half the cost of the land and the agreement for planting and management is to run until the year 2,000 A.D.

Oxford County now has the largest county forest in the Thames area, comprising 515 acres in five separate tracts. These are added to from time to time as land becomes available. Middlesex has 240 acres in three tracts. Forty acres were originally purchased in 1937 and two 100-acre tracts were bought in 1945.

3. UPPER THAMES RIVER CONSERVATION AUTHORITY FOREST

Following the recommendations of the preliminary report prepared by the Department of Planning and Development in 1945, the Authority has acquired 1,951 acres of potential forest land in the Ellice and Gads Hill Swamps and along Fish Creek which form the natural water-storage areas of some of the streams. Forty-four acres have been reforested along Fish Creek and a number of other areas are under consideration in the Authority's program of purchase and management of forest land at the headwaters.

4. MUNICIPAL FORESTS

Municipal forests are areas owned and managed by municipalities other than counties.

The three municipal forests in the Thames Watershed are: Woodstock 40 acres, St. Marys 10 acres, Stratford 8 acres; and the City of London has also done some reforestation work in the vicinity of its wells.

Some of the main tributary streams of the Thames arise in great swamps such as the Ellice Swamp which are the natural water storage areas and should be reforested.

Others arise as springs in pasture fields, here private owners should plant the surrounding slopes which are producing only sedge grasses and skunk cabbage.

5. DEMONSTRATION PLANTATIONS

In 1922 the Provincial Government began assisting municipalities to establish demonstration plantations on submarginal land. The only plot of this nature in the Thames Watershed was set out by the London Kiwanis Club in 1929. Unfortunately this was on heavy soil and over 50 per cent of the trees were girdled by mice.

6. DEMONSTRATION WOODLOTS

Demonstration woodlots are privately owned areas of woodland on which the owners have agreed to follow prescribed methods of woodlot management outlined by the Department of Lands and Forests, under the Zone Forester and to permit access to the area by interested persons. Such demonstration woodlots and the influence they exert for the proper management of similar areas contribute to the total conservation effort in any watershed.

Twenty-nine demonstration woodlots have been established in the Upper Thames Watershed—5 in Middlesex, 15 in Oxford and 9 in Perth County.

7. SCHOOL FORESTS

In order to encourage the establishment of school forests planted and cared for by school children, the Ontario Horticultural Association in 1945 organized an annual competition. Prizes are offered for the school having the best plantation and knowledge of forestry in each forest district in Southern Ontario and for provincial winners from the winners in the districts. Prizes for these competitions are generously provided by the Ontario Conservation Association and private donors.

8. 4-H FORESTRY CLUBS

These clubs are organized by the Ontario Department of Agriculture assisted by the Department of Lands and Forests, and must be sponsored by an organization interested in the improvement of woodland and reforestation.

Members must be between 12 and 21 years of age, and each member undertakes a project such as marking a half-acre plot of woodland for thinning, or reforesting a quarter-acre of land. Projects are judged annually on Achievement Day and prizes awarded; for this purpose the Department of Agriculture furnishes $3.00 per member and the sponsoring organization $1.50. Winners may enter the Provincial Inter-Forestry Club Competition.

The Counties of Middlesex and Perth each had one Forestry Club in 1950 and Perth came second in the Provincial Competition.

CHAPTER 5

FOREST CONSERVATION MEASURES REQUIRED

One of the most important conservation measures required on the Thames Watershed is the establishment of forest areas, to be called the Thames Forest, under the Conservation Authority, which will serve to protect the natural water-storage areas of the valley. Fifteen such areas have been defined, with the

In the Upper Thames Watershed two and a half per cent of the area or one acre in every forty is covered with scrub growth.

In a very few years these become "jungles" where not even trees can secure a foothold. The owner must decide whether he is prepared to clear the area or kill the scrub and plant trees to smother it.

acreages of woodland, willow scrub, hawthorn, open land and water in each. The names given to these areas are taken from the streams they feed or from nearby places. The total acreage recommended for acquisition includes natural water-storage areas and reforestation land to the extent of 18,334 acres, of which 7,621 have some form of tree cover, 2,811 are willow scrub or hawthorn, 7,690 are open land and 212 acres are water contained in small lakes or bogs. Of the 18,334 acres, 1,951 have been acquired by the Authority and 100 acres are owned by Middlesex County.

In addition to the fifteen major source areas there is a large number of small isolated tracts similar to those constituting the Oxford County Forest where the land is submarginal. These could and should be taken up as they become available and included as parts of either the Authority or county forests. They are shown on the Forestry map, distributed throughout the watershed. Many embrace no more than 100 acres but in the aggregate make up a considerable acreage of potential woodland which should materially improve water relationships in the watershed. These tracts total 18,906 acres in area with 4,139 acres of woodland, 11,921 acres of open land, 2,779 acres of scrub and 67 acres of marsh.

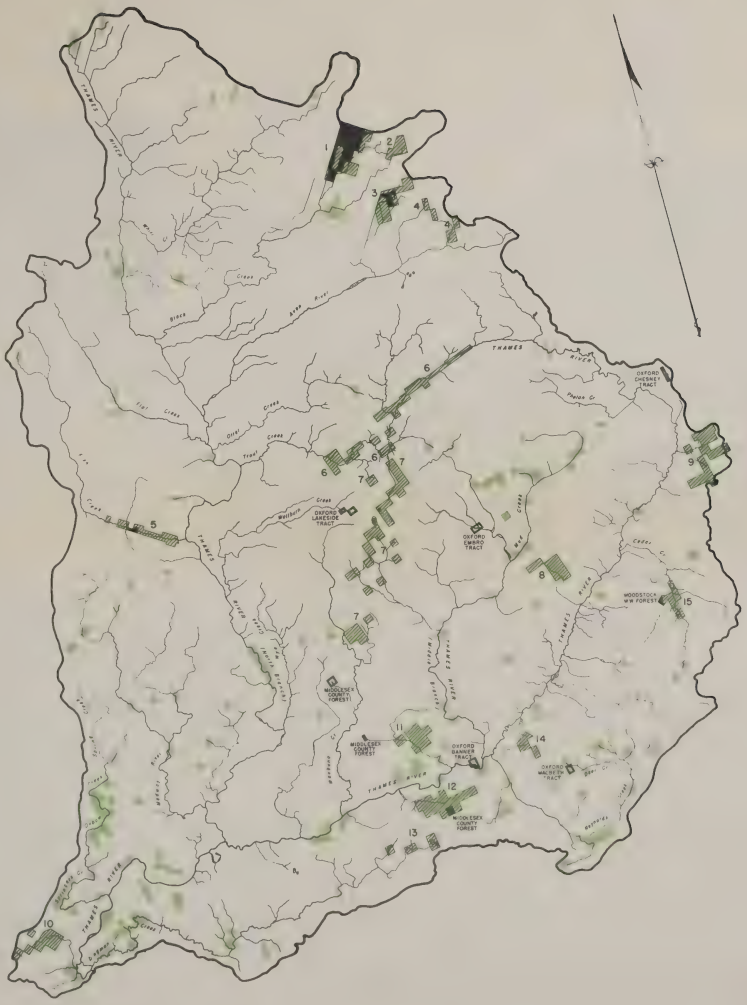
The total area of scrub land on the Upper Thames Watershed is 20,876 acres, of which 12,575 acres are dry scrub and 8,292 are wet scrub. In other words one acre in every forty is scrub land and absolutely non-productive. This is in the centre of the most highly productive agricultural area of Southern Ontario.

Scrub land has been placed in two categories: dry-sited scrub which includes such species as hawthorn, apple, sumach and witch hazel, and wet-sited scrub—willow, dogwood and alder. Dry-sited scrub land is usually land which has been over-grazed and neglected for many years. The soil may be unsuited to agriculture because of poor quality, excessive steepness or inaccessibility. On the other hand it may be fairly good farmland which the owner has not been able or willing to maintain in good pasture so that shrubs whose seeds are spread by birds and which are unpalatable to cattle have taken over the area.

Wet-sited scrub land is land with imperfect drainage, often bordering swamps. The bush has been cleared from it, but the subsequent pasture has been so poor that shrubs such as willow and dogwood, which require a damp site, have invaded the area.

Frequently scrub areas of these two types are only suitable for trees. They should be reforested and the acquisition of some of them by the Authority has been recommended.

Controlled woodlot management of privately owned woodlots must be established in some form before conservation measures can be co-ordinated outside the area of the proposed Upper Thames Forest. The average owner does not take a wide view of the value of forest cover for protecting stream flow. As a result the systematic cutting, both for lumber and firewood, which has been going on for many years, has done a great deal of damage. Areas connected in any way with the headwaters of streams should be controlled so that they cannot be clean-cut.



REFORESTATION LAND

LEGEND

- AUTHORITY FOREST
- RECOMMENDED AUTHORITY FOREST
- COUNTY FOREST
- OTHER REFORESTATION LAND

1. ELLIOT SWAMP
2. NORTH GADS HILL SWAMP
3. SOUTH GADS HILL SWAMP
4. AVON RIVER
5. FISH CREEK
6. TROUT CREEK
7. MURPHYS
8. GOLSPIE SWAMP
9. BLANDFORD
10. KOMOKA SWAMP
11. NORTH DORCHESTER SWAMP
12. SOUTH DORCHESTER SWAMP
13. FOSTER, BEATTIE AND TOOGAMIN LAKES
14. WOODRUFF SWAMP
15. CEDAR CREEK SWAMP

SCALE MILES

0 1 2 3 4 5

This is the former Perth County Forest now owned by the Authority.

Much of the remaining cover is poplar which will make pulpwood and improve the site for better species.

A portion of the Gads Hill Swamp where the Authority will restore the tree cover by natural and artificial reforestation

Provision is now made in the Statutes of the Province under The Trees Act which permits a county to pass a by-law regulating the cutting of trees on private land. Nineteen counties in Ontario have passed such by-laws, including Middlesex, Oxford and Perth.

The most progressive forestry action taken in Ontario since the establishment of an effective fire-fighting force was taken by the County of Halton in 1948, when the County Council passed a by-law to aid farmers in fencing their woodlots from livestock.

The by-law states that the County of Halton will grant a sum equal to the prevailing cost price of 8-strand fence wire with a single barb (not the cost of posts or labour) to a woodlot owner who will erect such a fence on one or more sides of his woodlot in order to enclose the woodlot completely, thus fostering forest growth by keeping livestock out. The woodlot must be of a size not less than two acres and livestock must be excluded for a minimum period of ten years.

Such action by the County Council is of infinitely more value than the planting of many trees artificially. It is recommended that the Upper Thames Authority adopt a similar scheme.

CHAPTER 6

FOREST INSECTS AND DISEASES

In any project, such as that proposed for the watershed, careful consideration should be given to the prevention of insect outbreaks and tree diseases, and arrangements made for control measures when necessary. There are a number of fundamental principles which will greatly lessen the destructiveness of these pests, which are set forth in the full report.

CHAPTER 7

LAND ACQUISITION

The problem of land acquisition should be approached carefully. It is not the practice in Ontario to overrule personal rights of ownership under the principle of eminent domain except to carry out works urgently required for the general good. The acquiring of poor land in the Upper Thames Watershed for reforestation may certainly be placed in this class and requires a more permanent authority than the individual to return it to its proper use. However, the problem should not be approached in a dictatorial manner and the willing co-operation of the people of the area should be secured by full explanation of the scheme and demonstration of its future benefits to the community.

The only parts of the watershed where large-scale transfers from private ownership to the Authority would have to be made are those areas which are recommended as reforestation land. The best farms in these areas need not be entirely withdrawn from agriculture where upkeep of public utilities is not too heavy. They could be incorporated in the forest as farmland and used by forest workers, since both farming and forest work are seasonal to some extent.

Crop shows little loss in size or vigour when planted close to European alder.

This is not the prairie but a windswept, treeless stretch of Perth County.

Contrast this farm home with the house above. The windbreak gives protection, comfort and stability.

There are several methods of acquiring land for conservation purposes. It may be transferred to the Authority by ordinary private sale, a maximum price per acre beyond which the Authority is prohibited to go might be set, or in some cases long-term agreements could be made with the owners for control of such parts of their lands as fall within the forest scheme. As a last resort, the Authority has the power to expropriate land for conservation purposes under The Conservation Authorities Act, R.S.O. 1950, c. 62.

CHAPTER 8

SNOW FENCES

The northern portion of the Thames Watershed lies in the Ontario "Snow Belt" and much of it is level land with little tree cover, exposed to strong winds which cause a great deal of drifting snow in winter. Much of the cost of controlling drifting can be eliminated by substituting permanent hedges of trees in place of snow fences. In addition to preventing drifting snow, hedges furnish many of the conservation benefits of windbreaks but on a reduced scale because of their lower height. Every encouragement should be given to their establishment.

CHAPTER 9

WINDBREAKS

In the process of clearing land for agriculture, woodlots and belts of trees along fence lines have been removed which served as natural shelterbelts. The restoration of these in the form of windbreaks is essential to a complete conservation program in many parts of Southern Ontario.

Benefits derived from windbreaks may be listed as follows:

1. Wind damage and lodging in small grains is reduced or eliminated.
2. Snow and the resultant moisture are more evenly distributed over fields, particularly on the higher parts where they are required most.
3. Moisture loss by evaporation is reduced.
4. Temperatures in the fields are raised, which may prevent frost damage, accelerate growth and even lengthen the growing season slightly.
5. Erosion of the soil by water and wind will be reduced.
6. Heat loss from buildings is greatly reduced.

The Authority should do everything possible to stimulate the planting of windbreaks throughout the Thames Watershed.

CHAPTER 10

SAWMILLING AND WOOD-USING INDUSTRIES

1. LOCAL WOOD-USING INDUSTRIES

Forest growth and the logging industry are predominantly hardwood.

In the area 79 establishments qualified as wood-using industries or intermediate handlers of lumber products. These have been separated into three general divisions as follows:

(a) Lumber merchandising, millworking, and allied fields;
(b) Miscellaneous general woodworking;
(c) Manufacturing specific wood products.

Some overlapping between the three groups seems unavoidable. The phases of the lumber and products industry encountered and the sources of their raw products are outlined.

(a) LUMBER MERCHANDISING, MILLWORKING, AND ALLIED FIELDS

Each of the 44 establishments in this group belongs in either or both of the following general categories:

(1) Lumberyards—retail and wholesale—may do millwork to varying degrees; some have an associated construction business; most handle the general builders' supplies.

(2) Millworking plants—primarily planing, matching and moulding; may be purely custom or may manufacture and stock their products.

(b) MISCELANEOUS GENERAL WOODWORKING

The 13 establishments placed in this category are typified by the extensive variety of products made by each enterprise, and by the fact that in general they are small consumption units, using less than 30,000 board feet of lumber in a year. They do custom work chiefly, but in some cases certain products may be stocked in quantity.

(c) MANUFACTURING SPECIFIC WOOD PRODUCTS

The 22 establishments in this group represent 10 different types of manufacturing:

Products Manufactured	*No. of Plants*	*Raw Material and Source*
Rowboats and small power boats	1	Softwood and hardwood lumber —local, regional and "imported"
Box shooks, boxes, crates, and cheese boxes	2	Softwood lumber —imported Hardwood logs and lumber —local
Slack and tight cooperage	2	Hardwood staves —American and "imported" Hardwood stave bolts —local
Caskets	2	Hardwood and softwood lumber —"imported" and regional —American "woods of value"

Furniture	6	Hardwood and softwood lumber, plywood —"imported", regional and American
Musical instruments	2	Hardwood and softwood lumber —American and local
Sporting and playground equipment	3	Hardwood lumber —local and American
Milk-bottle cases, dairy equipment, farm implement parts	2	Hardwood and softwood lumber —"imported", local and American
Veneer	2	Hardwood logs —"imported", American and local

2. SAWMILLING

Nineteen sawmills were in operation in the Upper Thames Watershed at the time of the survey. On the basis of figures supplied by their operators, the 19 mills annually produce about 2½ million board feet of lumber. Of this almost half is custom sawing and the remainder is termed "other sawing".

The 2½ million board feet is the approximate quantity annually produced by the 19 mills; it does not represent the annual volume of logging within the Thames Watershed. The reasons for this are obvious. Logs are hauled to some of these mills from points outside the survey area; trucks haul logs out of the area to other sawmills, veneer mills, etc.; portable mills move freely into the area.

There are no growth rate, yield or inventory data for Southern Ontario woodlots. It would be useful to determine whether the current annual cutting rate on all private lands or in a specific area is in excess of annual growth. Logging operators state that sawlog yield from hardwood stands in the general region of the survey is generally between 6,000 and 11,000 board feet (log scale Doyle Rule) per acre (or 15 to 30 cords of fuelwood). This yield is from stands of trees of mixed age from immature to overmature. On the basis of this general statement the annual cut of the 19 mills is approximately the yield from 300 acres of unmanaged woodland.

3. MILL OUTPUT—DAILY, ANNUAL AND CUSTOM

Daily output varies among the mills from 1,500 to 5,000 board feet, with the daily sawing rate for the majority of mills being 2,000 or 3,000 board feet. Only a few of the mills are operated on a professional basis. The daily output of a small mill varies almost directly as the number of men working and so can be increased—up to a point—by increasing the number employed. The output per man per day is about 1,000 board feet, with a predominance of hardwoods lowering this figure somewhat. Mills operated by non-professional owners may operate only a few days or a few weeks in a year. Thus annual production figures are of more significance than daily output figures.

Some damage in felling is inevitable even when logging is done by expert cutters.

Log skidding to roadside for truck haul.

The mill of largest output saws a little less than ¾ million board feet annually. The total output of the 19 mills is 2,420,000 board feet, the mills averaging about 130,000 board feet annually, and 69 per cent of the mills produce less than this average.

About 45 per cent of all the production is custom work; in general, as the annual output is greater the custom per cent is less. The 13 mills sawing annually 75,000 board feet or less spend more than 70 per cent of the time on custom logs and do about 36 per cent of the total custom work in the area. Mills sawing annually more than 75,000 board feet spend about 35 per cent of the time on custom logs; these mills do more than 75 per cent of all the sawing in the area. The three largest mills do a little more than half of all the sawing and almost 40 per cent of their output is custom.

When a woodlot owner needs a quantity of lumber for a new building or general repairs about the farm, he takes whatever logs he can to the mill. Often the value of the species and of the grades that could be sawn from the logs is far above that warranted by the use to which the material is put. He would be well advised to take credit for his logs and let the mill operator supply him with species and grades best suited to his requirement. The mill operator should supply these at preferred prices, since often he would profit by being able to dispose of his poor grades of low market value which he has on hand and in return receive a quantity of better grade material which can be diverted to more economical use. It is not uncommon that owners of small mills barter sawing or other services for logs.

4. LOG PURCHASE METHODS

There are two distinct sources of raw material from the viewpoint of the sawmill operator. These are (1) timberland, owned outright by the operator or on which he has cutting rights by contract, and (2) open log-market purchases. However, it is rather common for the mill owner to purchase a few selected standing trees in a woodlot at a stumpage rate or an outright lump sum, or offer a delivered-in-the-yard rate for the logs.

The owner may sell his sawlog material in one of three basic ways:

(a) Lump sum;
(b) Price per thousand feet on the stump;
(c) Price per thousand feet of logs cut.

In any lump sum purchase in an area where competition is keen the law of supply and demand should bring the owner the best price for his timber, provided competitive bids are sought from as many buyers as possible representing all the fields of manufacturing from logs.

Selling at so much per thousand board feet puts the sale on a volume basis. Usually the buyer puts each log in one of two or three grades and the top grade may be worth nearly three times as much as the lowest grade. The owner does not know the business of manufacturing from logs and the grading may lead to serious arguments. In any case it is in the interest of both parties to set forth their agreement in a written contract.

The owner may do his own log making and most sawmills pay $20 per thousand more for logs delivered at the mill. However, logging in hardwoods is heavy and dangerous work. Experienced men are not only able to work more quickly and efficiently, especially with power saws, but they know how to cut the logs so as to secure the maximum volume of high quality lumber. Skidding logs provides an easier field for owner participation and operators pay $4 per thousand for this work. Hauling logs to the mill is unquestionably the field of the specialized logging truck and is paid for at the rate of $10 per thousand.

The owner would do best to confine his efforts to growing the best logs possible, having the trees for removal marked by a competent forester, and realizing what labour income he can by working for the operator and removing the smaller products such as posts, poles, fuelwood and pulpwood.

Standard rules for grading logs do not exist. Much of the skepticism in the minds of woodlot owners toward log buyers would disappear if there were less obscuring of grading standards.

5. SPECIES SAWN

The average annual cut is about 10 to 15 per cent softwood. The chief softwood species are white pine and hemlock and the chief hardwoods sugar maple, white elm, basswood and white ash with lesser quantities of soft maple, beech, red and white oak, black cherry and poplar.

6. MARKETING

The marketing problem has three closely related aspects:

(a) The woodlot owner who has merchantable trees that will make sawlogs. The sale of his woodlot increment should be a paying proposition the same as any agricultural enterprise.

(b) The professional or semi-professional sawmill operator who requires logs that he can mill into lumber on a paying basis.

(c) The ultimate industrial consumer who requires definite quantities of certain species in certain grades in order to carry on his annual manufacturing on a paying basis.

These aspects resolve into getting the woodland products to the mills in sufficient quantity to make their handling profitable to the woodlot owner and the sawmiller, and assuring the consumer a continuous supply of standard grades at fair prices. Various attempts have been made to solve the problem of marketing woodlot products. One of the most successful experiments was conducted under the direction of the District Forester at Hespeler. In this case the owner, as a co-operator with the Department of Lands and Forests, agreed to sell only trees marked by the forester, who marked 233 trees with an estimated volume of 47,600 board feet. The estimate data were turned over to a timber agent chosen by the department, who entered into a written agreement with the owner to (a) solicit tenders, (b) draw up a sale contract, (c) check cutting operations, (d) measure and collect payment for all wood before its removal. The agent received a commission on the gross sale value. Prices

realized by the owner were much better than average, the woodlot was left in a fine growing condition (it is planned to make another cut of 25,000 board feet in 15 years) and the operator and agent were completely satisfied.

In March, 1950, a co-operative for marketing woodlot products was established in Lanark County. A manager has been appointed to locate markets, arrive at price schedules, collect payment for products and advise members on the best methods of cutting. The membership fee is five dollars, the co-operative takes 5 per cent of the sale value, and members pledge themselves to supply the quantity and quality of material at the time and place agreed upon.

If in its infancy the co-operative makes a profit for its members by the sale of products which are difficult as well as those which are easy to sell and guides its members in the path of woodlot management, it will do a great deal to assist conservation in the area.

Farmers often do very little of the woods work. This lump sum purchase bought only the logs that could be made. The farmer paid the buyer's cutting crew to make the tops and limbs into 4-foot fuelwood.

4

WATER

CHAPTER 1

THE RIVER

1. TRIBUTARIES AND WATERSHED AREAS

The Thames River drains 2,252 square miles of densely populated and for the most part excellent farmland in Southern Ontario. It rises in the highlands of Perth and Oxford Counties north-east of London and carries water more than 190 miles to Lake St. Clair.

Above London the Thames has many tributaries all of which drain into three main branches, namely, the North Branch, with a drainage area of 661.4 square miles, the South Branch with a drainage area of 396.4 square miles and the Middle Branch which joins the South Branch approximately five miles west of Ingersoll with a drainage area of 132.8 square miles. The South Branch joins

the North Branch in the city of London, the whole drainage area above this point being 1,190.6 square miles.

2. SUMMER FLOW

The problem of summer flow is not so acute on the Thames as it has become on some other rivers in Ontario. Even during the period of low flow in the late summer months, there is usually enough water in the main branches to prevent excessive pollution.

The fluctuations in flow appear to have been less before the clearing of the forests. The river on the average seems to have had more water in summer than is now the case. It is plain that many of the tributaries had longer courses before 1880, and some streams which are now dry in summer were then flowing all year round. The cutting of remaining woodlots since that time and the draining of swamps and wet land have reduced the amount of water storage so as to have a marked effect on the river. The references to trout being caught even in the larger tributaries of the Thames, in early times, show that a change has taken place in the river which is not entirely due to the pollution of the water. In some cases mills were located on small streams which would not now provide enough power to run them during most of the year. As early as 1895 a complaint of decreased flow in the Thames is found in the St. Marys Argus. It is probable that since 1860 the bed of the river in many places has been scoured out and the banks undermined by floods so that the streams run broader and shallower than before. In a few places the river bed has been artificially widened and deepened as a measure of flood protection.

The records of stream flow near London, which have been kept for the past thirty years, indicate that September is normally the month of lowest flow on the North Branch and August on the South Branch. Years of low flow in the summer and autumn have been frequent, the most pronounced period occurring in 1936 on both branches. In that year the combined flow of both branches averaged 45 cubic feet per second for the three months of July, August and September, and for the four months of July, August, September and October the flow was 57 cubic feet per second.

There is no evidence that this condition is becoming more pronounced of late years, and complaints of the unpleasant consequences of low flow are only met with in a few localities. A better regulated flow in summer would, however, be very desirable as population and unavoidable pollution increase, especially if the possibilities of the river for recreation are to be developed to the full. The planting and protection of source areas, highly desirable for other reasons, would have a great effect in increasing the volume of water in dry seasons, and this could be supplemented from the reservoirs necessary to control floods and from recreational lakes.

3. ENCROACHMENTS

Encroachments include any works of man which are built on the natural flood channel of a river. These flood channels may not be used by the river for several years, but at certain intervals, due to excessive precipitation and

other factors, this supplementary channel which it has created for itself will most certainly be flooded, because it must be remembered that flooding is a natural phenomenon of rivers.

In the process of settling a new country, encroachments are often unavoidable because, as is well known, many of our towns and cities were established by the erection of a mill on the river or at the junction of a small stream with a larger one. Gradually as time went on, other businesses followed, shopping districts were built up and spread out around this nucleus of settlement. Thus it happens that such towns, or the older part of them at least, are completely within the flood channel, and when high water occurs, they, of course, are flooded.

The presence of encroachments such as narrow bridges with abutments projecting out into the river valley, factories, buildings and so forth, not only aggravates the flood situation from the standpoint of preventing the free passage of water but also by piling up large cakes of ice which naturally float on the crest of the stream in the spring, accumulating behind these structures and building up a dangerous dam only to break when the pressure becomes too great or the temperature modifies. These encroachments together with the gradual denudation of the forest, especially at the headwaters of the rivers, have aggravated the flood situation on most of our streams in Southern Ontario, and it is largely due to these causes that some major works must be undertaken, chiefly in the building of dams or the building of dikes, in order to protect the towns and cities which occupy the river channel in whole or in part at certain points on its course.

If the extensive system of dams recommended elsewhere in this report is built to safeguard adequately the towns and cities on the Thames River from any anticipated floods, very careful consideration should be given by all municipalities to the controlling of further encroachments in the flood channel. It is not only possible but highly probable that, if encroachments are continued as they have been carried out in the past, in years to come the effectiveness of works for the prevention of floods will be seriously reduced. Therefore, one of the chief concerns of the Authority in planning a long-term program for the river valley should be to control and check further encroachments on the river, especially where they are costly permanent structures and will involve the loss of property, goods and human life.

CHAPTER 2

FLOODS

The flood on the Thames River at London in April, 1937, brought the question of floods and flood damage more forcibly before the public than had been the case at any time since the early years of this century. It was the highest flood recorded on the Thames, and was also the most destructive of property. In discussions of this flood and of those which had occurred in the past, it was often taken for granted that floods of a serious nature on the Thames were comparatively modern phenomena, directly connected with the spread of settlement and the clearing of the forest. It was said, truly enough, that there

were no accurate and scientific measurements of the flow of the river or the height of the floods until after 1928. Such accounts of early floods as were known to exist were considered unreliable, not only on the reasonable ground of the lack of scientific data, but also in the belief that their authors had exaggerated the severity of the flooding owing to the fact that, being unused to serious floods, they had no standard of comparison. The following account of floods on the Thames between 1791 and 1951 is intended to throw some light on the number and extent of these floods, the weather conditions when they occurred, the amount of property damage and the effect which settlement in the area had on flooding.

1790-1849

The first direct reference that has been found to a flood on the Thames is contained in the field notes of Patrick McNiff, who had completed a survey of the lower part of the river. He reports that on April 18, 1791, he found, at the point just below Moraviantown where he ended his survey, "that the water had been Twenty feet above its then height." It was even then running eight feet deep at that point, with an eight-knot current, although he was told that a loaded canoe could hardly pass in the dry season. This would mean a rise of about 25 feet or more. McNiff adds that he was told that the flats from the end of his survey to "the second village of Delaware"* (near Muncey) "are at times overflowed."

The flood of 1791 would thus appear to have been severe and that of the spring of 1792 was probably nearly as high. Evidence of this flood and a detailed record of the behaviour of the river from 1792 to 1798 are to be found in the records of the Moravian Mission at Old Fairfield or "Schonfeldt" on the Thames opposite Moraviantown (New Fairfield). This village was built for Christian Delaware Indians driven out of their homes in Ohio by the Americans. While still at Detroit, before they had even visited the Thames, the Moravian Brothers were told by Indians that the spring freshets were formidable. When they moved up the river to look for a village site they found plain signs of recent flood. Going beyond all settlement, they found the current too strong for their heavy boat and had to make use of the canoes of some local Indians. They spent the next few days exploring the river. As they had come from the Muskingum, they were on the lookout for signs of flood and on April 27 they note that "along the river there is abundance of good and fine land, only in the spring it is flooded." In the entry of the 28th they are more definite: "We found out and saw that in the spring the river rises twenty feet or more, therefore all the bottoms are covered." Zeisberger evidently concluded that this was a yearly occurrence, which proved to be a mistake. A rise of twenty feet in the region between Moraviantown and Muncey indicates a pretty severe flood, such as comes only once or twice in ten years.

*There were two "Delaware" villages above Moraviantown, the first near Middlemiss and the second (the "Delaware Castle") on high ground near Muncey. They were both occupied by Munceys or Monseys, a tribe of the Delaware Nation. The Munceys were usually called Delawares by the English at this time. Zeisberger, however, always distinguishes between the "heathen" Munceys and his Christian Delawares. There was no white village of Delaware at this date.

South Branch flats during the flood of April, 1937.

Part of West London during the flood of April, 1937.

The Brothers chose a site for their village, taking care to place it out of reach of such floods. This was at first a little higher up the river than the site finally occupied, but, at the final site also, care was taken to choose a situation on the higher terrace, near a spring creek. On May 1—"In the forenoon we visited the country farther up and found good enough planting-land though wild, but no place for a town, since the places either go under water or are very high hills on the river." After they were finally settled at Old Fairfield, the Brothers continued to report the movements of the river (often calling it "the creek"). On May 17 after three days' rain, "the creek rises fast"—the context makes it plain that the river is meant. Again on June the 9th, "from the very hard rains the river rose very much so that it is very muddy. It is therefore a fine thing that we have a good spring nearby, back of the town."

In the diary of 1793 is found a pattern of weather conditions which is to become familiar later on. A mid-January thaw melted the snow but caused no freshet. On March 16—"For two days it has rained. The river rose high." By the 19th, the river had "so been rising for several days that it has overflowed the lowland and many fields." The height of the rise is not given so it was probably considerably less than the year before. On November 6th, after several days of rain, "the river is risen very high" but no flooding is recorded. Governor Simcoe's party encountered the beginning of the March freshet of 1793 on the upper waters of the Thames near Woodstock, while returning from Detroit.

If 1793 was a fairly normal year, 1794 was exceptional in several ways. Lower down the river, on MacGregor Creek, the freshet of March, 1794, destroyed the dam and damaged the foundation of MacGregor's mill, not far from the site of Chatham. At the end of the month Colonel Simcoe took advantage of the high water and swift current to descend the river from Woodstock in a boat.

The year 1795 marked a flood in the autumn, for on Sunday, October 18, we find the following entry: "Michael preached, and as it has been rainy the whole week, so that the river was unusually high, and the corn of several brethren under water, they helped one another to save it, whereby all were busy who were able, and so they continued to do the next day, for the water was all the time rising."

The break-up of 1797 came on March the 16th.* The next day "on account of the high water many pine timber saw-blocks came down the river, many of which our Indians secured." This shows that Allen's sawmill yard at Delaware had been flooded. On March 31, "After the high river had fallen, the snow having melted, hard rains came in and it rose again." Many rafts "of pine lumber" went by in April and the beginning of May.

In 1798 the sap was running on February 3. Most of January had been fine and mild. From February 19 till near the end of March, there was cold and heavy snow. On the 27th "the river broke up, with warm weather and high water." On April 3 the water was "higher than it has ever been here and we

*William Parrin Law notes a flood on the South Branch between March 14 and 16, 1797, in his diary of the Survey of Blandford. Lands and Forests Survey Records—Field Notes; Vol. III, p. 121.

hear that the snow above us, only three days ago, was kneedeep and therefore the river will still rise, when it has already come up more than 20 feet."

Zeisberger's diary ends in 1798 and for the next twenty or thirty years our information about the river's movements is scanty and there are few detailed flood references.

The use to which the inhabitants put the freshets during the first fifty years of settlement is well illustrated by the references to rafting and by Simcoe's second trip down the river. The periodic swelling of the rivers and streams played a large part in the life of these settlers on the Thames, as it did elsewhere in the Canadian bush. George Heriot, in his "Travels Through Canada, 1807", has an interesting passage on this subject. Speaking of the advantages enjoyed by the farmers along the St. Lawrence, who could ship their produce to market on rafts at any season, he writes: "on all other rivers except those of the first magnitude, they who mean to conduct rafts down their stream are compelled to be ready at the moment of a swell of the waters"; otherwise they might have to wait for a whole year. He also says that it sometimes happened that the "spring freshets are not sufficiently high" for rafting. This had occurred on the Thames in 1806, when the lumber was piled up in the yards of the sawmills at Delaware and at Dorchester waiting for enough water to raft it to Detroit.

"High water" on the South Branch, lasting from April 3 to April 9, interrupted William Hambly's survey of lots on Dundas Street (Governor's Road) in 1800. Hambly also records finding a great flood on the Lower Thames and all the low ground under water when returning from a survey near the Sydenham River on September 13, 1804. Nathan Bangs, the first Methodist circuit rider to visit the Thames settlements, mentions encountering heavy flooding a little higher up the river in October and November of the same year.* It is not certain whether any other floods occurred on the Thames in this decade. Plain signs of flooding, that had covered the North Branch flats in the second Concession of London Township to the depth of three feet or more, were observed in the summer of 1810 and it is likely that this flood had been fairly recent.

Between 1810 and 1830 only one definite reference to floods has yet been found, though there are several general references to the "periodic inundation" or "annual overflowing" of the flats. When this was of normal extent it was considered an advantage because it enriched the meadows with silt. It is likely that one or two heavy floods occurred during the war of 1812-15, for flood damage is reported from other rivers. Floods on Springer's Creek and the Medway in 1819 interfered with Mahlon Burwell's survey of Lobo or with his journeys to and from that township. A series of mild years after 1822, with dry summers and open winters, caused a shortage of water in South-western Ontario so that swamps and streams dried up and mills could not grind. It is not likely that there were other serious floods before 1829, though there are some references to high water. After 1826 the population of the area was growing; traffic was increasing on the roads; bridges and mills were built and towns laid out. Flood damage became more important and was more often reported.

*The flood in September brought down a quantity of driftwood and was probably severe over the whole watershed, for severe floods occurred at the same time on rivers near Toronto.

In 1830, "the London stocks which had fallen into disfavour as a punishment, were formally committed to the Thames in spring flood" by the constable. "The London Bridge was broken" in the late summer of that year, probably as a result of the flood. Other references to floods at about this time are not uncommon in the diaries and reminiscences of the early inhabitants of London. We are told that this bridge at the foot of York Street (built in 1826) was chained to some large trees "to prevent it being floated away in the spring floods." Samuel Strickland, speaking of his visit to Chatham in 1832, remarks that the flats on either side of the river for the first ten miles from its mouth were usually flooded in the spring.

The mill dam built by the Canada Company at Stratford in 1832 was damaged several times by floods before it was finally completed at "enormous" cost late in 1837. One of these floods took place in 1833, when there is evidence of flooding on streams near Komoka. Another was the flood of 1836 by which the bridge at Chatham was destroyed and "the bridge over Rhode's milldam was carried away" before April 9, when the Reverend John Proudfoot attempted to cross it. The stream was evidently too deep to ford on horseback and the Presbyterian minister of London was not accustomed to "swimming his horse through the swollen streams" as the Reverend Mr. Cronyn was in the habit of doing at this time. The flood of 1837 damaged bridges in the London District and possibly also the dam at Stratford.

The rebuilt bridge at Chatham was again damaged in 1841 and in 1843 damage to the Delaware and Kilworth Bridges is reported. The bridges must have been impassable, for on Easter Sunday (April 16), four members of a party of fourteen who tried to cross in a scow at Delaware were drowned when the scow caught in the branches of a fallen tree and was swamped. At about the same date, a party of indignant citizens set out from London, bent on destroying "Gardiner Bros.' mill dam in Mosa", but finding the dam "partially destroyed by the flood and the water too high", they contented themselves with threats and marched off to the nearest taverns. This dam was unpopular with both lumbermen and fishermen because the chute provided did not allow rafts to pass at times when the river was high enough for rafting everywhere else and because the fish could only pass it "at the high floods".

The spring flood of 1846 appears to have been long and severe. Marcus Gunn records in his diary for March 13, "Great Waters pass in the rivers." On the 26th, he says, "The rivers appear occupied with magnificent Waters." He uses almost exactly the same words to describe the flood of 1852 so that this flood was probably of about the same degree of severity. It is not till April 4 that Gunn notes that "the rivers are now much fallen." On January 2, 1847, he writes, "the river is much swollen with waters" and on January 12, "the river appears filled with ice and the waters accumulate and overflow." On April 4, 1847, Gunn records mild weather and a thunderstorm. The next two days were "mild and springlike," and on the 8th: "The River exhibits great elevation of waters reducing its banks in our vicinity." On the 9th: 'The waters of the River are still more elevated today," and on the 10th: "The Rivers are still overflowing with water." Gunn's language is somewhat ambiguous but there can be no doubt that these were floods of impressive size.

Strengthening flood dikes east of the Town of Ingersoll.

Island in Stratford Park below Huron Street bridge disappears under flood.

It is stated that the bridges in London and its neighbourhood before 1849 "were constructed of wood and frequently destroyed by the spring floods." It would not need a very severe freshet to damage some of the bridges of that time. An attempt to raise the bridge above the height of the floods seems to have been made in some instances. The building of more mill dams and bridges in the forties probably helped to increase the severity of floods, by causing ice jams in the river.

1851-1879

When detailed reports of floods began to appear in the newspapers after 1849, ice jams and damage from ice are often reported. This was the case in March, 1851, when three days of rain "with the snow in the bush" made the Thames "burst all bounds." A block formed at Shepherd's mill dam on the South Branch, and when it broke the ice swept downstream at "eight or ten miles per hour."

A bursting mill dam ("Benson's") at Ingersoll was responsible in 1856 for a flood that destroyed buildings and bridges, doing $5,000 damage.* At London "Hunt's new mill dam" was destroyed and Clarke's Bridge damaged. This bridge (built first in 1841) was wrecked in the spring flood of 1857, which seems to have been generally severe. The thaw took place on February 6 and 7 and the water in the neighbourhood of Clarke's Bridge was eleven feet or more above "the normal level." The Avon flooded cellars at Stratford and destroyed a quantity of wheat, and this flood did a great deal of damage at Delaware and at Chatham.

The flood of 1861 caused more loss and attracted more attention than that of 1857 because the low ground in the towns was by then more built up than four years before. The North Branch flooded parts of St. Marys. Roads and bridges were damaged between St. Marys and London, and Kilworth Bridge was "finally carried away."

In March, 1865, and again in February, 1867, the river rose "above its ordinary (spring) level of ten to twelve feet." Several bridges suffered as they did again in 1867. This led the London Free Press to criticize the short-sighted policy of building cheap bridges which were swept away in every flood.

The flood of 1868 was one of the very severe floods on the Thames. The damage on the Upper Watershed was heavy, especially on the North Branch from Mitchell down. There was a flood on Trout Creek and three people were drowned in the neighbourhood of Fullarton. But it was the lower part of the river valley that suffered most. This was due to a huge blockade of ice and debris at the river's mouth. The type of driftwood in this block indicates the amount of lumbering on the upper waters. It included great quantities of "cordwood, timber (squared), staves and brushwood." The block formed on March 13, after the first freshet had passed, and it backed up the waters so as to flood much of Chatham "four or five feet deep." Miles of country around were covered several feet deep. Vessels were washed from their moorings and

*This was probably the same dam on the creek that caused damage in several other years. In 1887 a house was washed away and four people drowned.

railway traffic was interrupted for days. The water in Chatham was about eighteen feet "above the summer level and two feet above high water mark of last year." This flood was considered at Chatham "by far the greatest . . . in thirty years." It was not to be equalled there for thirty years more.

The more serious floods of the 1870's all occurred between January 24, 1873, and January 24, 1874. The spring freshet of 1873 flooded the London flats "from the cove bridge to the foot of Dundas Street." On the Kensington (West London) flats, which were just beginning to be occupied, the water was ten feet deep in places for "forty hours." Thamesville and Chatham were heavily flooded and the railway bridge at Chatham was washed out, along with many other bridges and mill dams. Floods and flood damage are reported from Mitchell, St. Marys, Stratford, Woodstock, and other places.

On December 4, 1873, a furious storm spread destruction over the country and floods occurred on several rivers. The flooding on the Thames, however, was not entirely due to this "hurricane." There had been sleighing in November, but a thaw began and heavy rain fell on the northern part of the watershed from the 1st to the 3rd of December. The North Branch and its tributaries were already flooding by the 3rd and doing damage at Stratford and Mitchell. When the "twister" struck there was heavy wind damage and more serious flooding.

At London the wind wrecked a number of buildings and "to add to the seriousness of the situation, the river, already swollen by the thaw, overflowed and again flooded the flats." The river was "a foot higher than during the great freshet in the spring." At Chatham the water rose "about three feet above the docks" and flooded part of the town.

The flood of January 23, 1874, was the highest of the three. Kensington was flooded to a greater extent than ever before. Chatham and Thamesville suffered again. A railway accident was caused by a washout at Thamesville. Two miles of the Great Western Railway track, west of Chatham, were under water and all traffic stopped for some days.

The great quantity of "brushwood, timbers, staves and sawn lumber as well as saw logs" which came down with this flood is an indication of its extent on the upper watershed. They also show that the lumbermen were busy and that the forest was fast disappearing. From 1868 till well into the '80's this type of flotsam caused a good part of the flood damage, either directly or by forming blocks which raised the height of the water. After 1885 it is seldom mentioned.

1880-1899

The next eight years, however, produced only sharp freshets and local floods, mostly on the North Branch. Three of these occurred in the spring of 1881.

March of 1883 saw Kensington again "completely flooded" and the boats again busy rescuing the inhabitants. But, though the spring flood was severe enough, it was completely overshadowed by the catastrophe of July 10-11, 1883. All future floods were compared to that of 1883 and it was many years before any could be said to have equalled it in severity.

The immediate cause of this disaster was an electric storm which moved over part of the watershed in a wide circle, with its centre near London. The ground was already soaked by heavy rains and the creeks and rivers swollen to an unusual height. There had been flooding in several places and washouts had caused railway accidents along the South Branch a few days before. The Thames was very high on the 9th of July, but it dropped considerably on the 10th. That night, a little before midnight, the storm broke and three inches of rain fell in three hours. At three a.m. on the 11th, a "wall of water" swept down on Kensington from the north, washing many houses from their foundations and carrying them downstream to be crushed in some cases against the bridges. There was no warning in Kensington, though the storm had roused many from their sleep. People were drowned in their houses or trying to reach higher ground and one child was crushed by the fragments of its home as it was being handed to its mother who had taken refuge in a tree. The few two-storey houses mostly stood firm, one giving shelter to fifty people. The loss of life might have been greater if boats had not been got out at once to take people to safety. The London fire-bells rang for hours, so that when the South Branch rose, later in the morning, the alarm had already been given. No lives were lost in that quarter, although six acres of land disappeared completely from above Clarke's Bridge, leaving only a bed of fresh gravel. With the soil went five houses, their stables and sheds and all their contents. The other flats on this branch were swept also. Eighteen people were killed in all, including several children, and a great number lost all their possessions. The flats downstream were strewn with trunks, furniture and the wreckage of houses.

Thunderstorms in Logan Township and near Fullarton on the 12th must have prolonged the flood at London. The North Branch flooded flats in that area, destroying fences and hay. Otherwise the area of destruction did not extend much above Thorndale on the North Branch or above Ingersoll on the South Branch. At Thorndale the mill dam burst and some houses and a church were moved from their foundations. The bridges from Springbank to Delaware were broken by the steamship Princess Louise,* as it was swept down to the Delaware flats, where it came to rest a complete wreck. Crops on the flats were damaged as far down as Chatham. At Chatham the debris broke the railway bridge, but the flooding in the town was not as serious as in 1868.

It was the unexpected and appalling force of this spate that distinguished it from all others. The height of water on the South Branch (13 feet) had been equalled by former floods. On the North Branch the height was greater, since it was swollen by the contents of mill dams at Thorndale and elsewhere. The height over the waterworks dam at Springbank (12 feet 11 inches) was to remain the highest for fifty years or more.

Another of the very severe floods on the Thames took place in 1898. This flood was heavy on both branches. All the flats on the South Branch were under water. West London was not seriously threatened at first, though the embankment was leaking and people were warned to leave. After a sharp rise occurred on March 13, eighty feet of the dike suddenly collapsed. The water

*One of two pleasure boats of some size, plying between London and Springbank Park on the reach of deep water formed by the waterworks dam. These steamers are mentioned in the accounts of some later floods.

Looking North from the C.P.R. tracks at Park Street towards Queen Street, St. Marys, April 7, 1947.

From the same point July 18, 1950.

rushed in with great force, cutting off those who had delayed in their houses, dispersing a large crowd of onlookers, and forcing the Mayor to scramble onto the roof of the carriage in which he was driving.

As in 1868, this flood was much more severe at Chatham than elsewhere. There had been very heavy rain, but the ice on Lake St. Clair was still solid. These factors, combined with a strong west wind, raised the water at Chatham to about eighteen feet above normal. The flood of 1899 was nearly as high as the year before but no special circumstances at London or Chatham aggravated its effects. The river rose "eleven feet in four hours," flooded the flats on the South Branch and broke the dam at Springbank. The West London dike was still "hard frozen," so that this suburb escaped.

1900-1919

In three of the first four years of this century heavy floods did damage in various parts of the watershed and caused anxiety at London. No serious damage occurred there, however, until the flood of March, 1904. This proved to be one of the most severe. Most of the ice on the North Branch went out without doing any harm, but an ice jam at St. Marys broke at 4.30 p.m. on March 25. The flood came down the North Branch with "terrific speed." The South Branch broke up about the same time and by 11.00 p.m. the flood on this Branch was "something tremendous." All the low ground in that section was flooded several feet deep. The breakwater protecting West London was patrolled all night. It was strengthened with sacks of sand and until after midnight it seemed to be holding. At 1.00 a.m. on March 26, "those people who had gone to rest (in West London) were awakened by a horseman galloping furiously through the streets shouting that the breakwater had given way." The water flowed over the dike as well as through the breaks. A young man, who had gone out in a canoe to help take people off from the houses, was upset and drowned. Thamesville was completely flooded and at Chatham the flood was the highest since 1898.

As a result of these floods, the dikes at London were lengthened and rebuilt in 1905. For the next twenty-five years, although other parts of London and of the watershed suffered several times, West London escaped with only some alarms of floods.

The floods between 1909 and 1929 were rendered more serious by ice jams that sometimes turned moderately heavy floods on the upper river into severe ones at Chatham and below. This happened in 1910, when a five-mile ice jam at Prairie Siding backed up the water for three days and flooded the city and miles of the low ground. Farmers suffered heavily and there was serious damage to the railway. The situation was very similar in 1912, 1916 and 1920, but in 1912 the flooding was more widespread on the upper watershed and below Chatham somewhat less so than in 1910.

The break-up in 1912 was accompanied by heavy rains. The Thames was more than ten feet above normal at Chatham on April 1. On the 2nd, the river had risen to fifteen feet and the country above and below Chatham was flooded. An ice jam, two miles long, formed at Prairie Siding. By the fourth

of April the water had reached 16 feet 7 inches above "high water mark" at Chatham, and wide stretches of country were under water from the river's mouth to above Kent Bridge. The flood was "the highest since 1904" and took some days to subside. Severe flooding on the North Branch caused serious damage in Mitchell, Stratford and St. Marys, forcing mills, factories and quarries to shut down and sweeping away dams and bridges over much of Perth County. A severe flood was expected in London, but the damage there was not serious.

The North Branch flooded again in the following January, doing serious damage near St. Marys and causing ice jams above Broughdale. The March flood of 1913, however, was most serious on the South Branch, especially near Ingersoll. The southern flats at London were not protected by dikes and were badly flooded. The waterworks dam at Springbank broke on March 30 as the result of the freshets.

Again in 1918, the floods covered parts of London not protected by the main dike. The flooding was chiefly along the South Branch, where the river flooded the gasworks and put out a fire which had burned for five weeks under the C.P.R. tracks.

1920-1939

The heavy flood of 1929 was chiefly felt in North London which was growing into a populous suburb. There was a serious ice jam on the North Branch in that neighbourhood. The water was said to be higher there than at any time since 1883. The West London dike was pierced near Douglas Avenue, but it was quickly repaired and little harm was done.

In 1930 the water in the Thames was above normal height through most of January and February. The mean discharges for both months were exceptionally high and, though no very unusual peaks were reached on either branch, several freshets occurred. Ice conditions turned some of these into severe or heavy floods above Chatham. There was flooding at Woodstock on January 8. The river rose and fell several times in the following weeks without serious flooding. It was rising once more at Chatham on February 21, but it was not till February 23 that heavy flooding took place at Stratford, St. Marys and Ingersoll, and on the unprotected flats at London. This flood was over on the upper part of both branches by the 25th, but at London both branches were still rising six inches an hour. Thamesville was now completely cut off from any form of communication except by telephone, and there was four feet of water on Highway No. 2 in that vicinity. At Chatham the flood was thought to be "possibly the highest since 1904." The slow rise had reduced the damage in that city and below Chatham the flooding was not increased by ice jams.

In March, 1935, heavy freshets on both branches caused a rise of 17 feet at the Douglas Avenue gauge in London, but because there was little ice no serious flooding occurred. In 1936 an ice jam at Prairie Siding again turned a moderate freshet into a serious flood below Chatham, but on the whole the Thames Watershed suffered less than the rest of the Province in 1936.

The great flood that visited the Thames Watershed on April 26-30, 1937, still remains the highest on record and, as regards destruction of property, is

probably the most severe since the watershed was settled. It was caused by heavy and prolonged rains. The snow had melted completely and it is believed that the frost was out of the ground. A flood after the first thaw has melted the snow is not uncommon on the Thames. The two most disastrous floods since 1800 took place without snow to increase the run-off, when the ground, though sodden, was not frozen and when the river was free from ice.

The rainfall at London up to April 21 had been only slightly above normal for the district. But during the next week 5.48 inches of rain fell at London as against a normal or average rainfall of .56 inches, an excess of almost five inches above normal. The following table shows the daily rainfall and temperatures at London from April 21 to April 27, 1937.

PRECIPITATION AND TEMPERATURE AT LONDON,
APRIL 21-27, 1937

Date	Precipitation			Temperature	
	Inches	Total from April 1	Normal Total from April 1	High	Low
April 21	....	2.26	1.86	54	38
April 22	1.40	3.66	1.96	42	42
April 23	.04	3.70	2.04	42	34
April 24	....	3.70	2.14	42	36
April 25	.20	3.90	....	..	..
April 26	1.82	5.72	2.32	46	38
April 27	2.02	7.74	2.42	40	32

The flood at London began on April 26, when the North Branch rose 15 feet at Fanshawe in a few hours. The flats on this branch, with the suburb of Broughdale and a part of North London, were all flooded. At Broughdale the water was running over the highway on both sides of the bridge, more than 18 inches deep and with a strong current. The flood overtopped the West London dikes, spreading over a wider area than in any flood since the dikes had been rebuilt in 1905.

In the meantime the South Branch had risen 13 feet 9 inches at Ealing, and continued to rise for some hours after the North Branch had fallen. During the morning of April 27 it reached the record height of 21 feet 6 inches above mean summer flow at Ealing, continuing at nearly the same height till afternoon. At the Douglas Avenue gauge, just below the confluence, the combined floods reached 17.19 feet above the bottom of the gauge, or about 23 feet above "normal summer level with the Springbank dam closed."

There was heavy damage to roads and bridges throughout the watershed above Thamesville and in almost every case, except at St. Marys, the greater part of the damage in the towns was done by smaller creeks. Even at St. Marys a large part of the loss was caused by the flooding of Trout Creek.

At Stratford the flood on the Avon washed out the dam of the lake in the centre of the town. The damage to private property was chiefly caused by

London West from the Court House, July 1883.

London West from the foot of Carling Street, April 1937.

Erie Creek, a small stream, now flowing underground through part of the town. Woodstock suffered damage to public and private property and here also it was the flooding of a small tributary—Cedar Creek—which caused most damage. The mill dam and the highway bridge at Thamesville were injured and a dam at Embro was broken.

The Canadian National Railway line between Woodstock and Ingersoll was inundated and a washout wrecked a train and interrupted traffic for a considerable time. The quarries near Beachville were flooded and very large estimates have been received of the damage here and to the industrial plants near Ingersoll. In Ingersoll the factories near the river were the chief sufferers, with some damage to private property.

Below London the flats were all flooded more or less. The whole village of Thamesville was overflowed and all access cut off except by boat and the Canadian National Railway right-of-way.

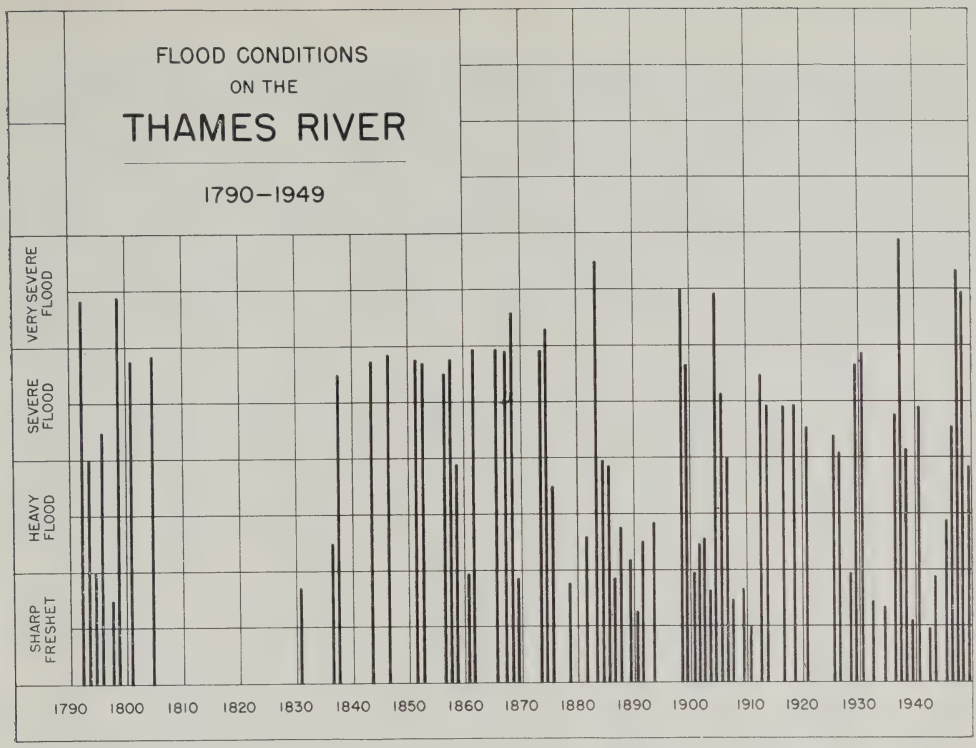
The flood took sixty hours to travel from London to Chatham, compared with about seventy-two hours in 1865. The flood crests reached Chatham on the 29th and 30th of April, so that the city had some warning in advance that a severe flood might be expected. The rainfall at Chatham had been only about two inches as against nearly six inches in London. This fact may have led the inhabitants of Chatham to under-estimate the probable height of the flood. Otherwise, it would have been possible to reduce the amount of loss by removing more of the threatened property.

The peak elevation of the flood at Chatham was 19 feet 8 inches in 1937. In 1868 it reached approximately 19 feet and in 1898 about 18 feet. The latter figures appear to be definite measurements like those taken at Springbank after 1877, and not merely estimates as are all the early elevations given at London.

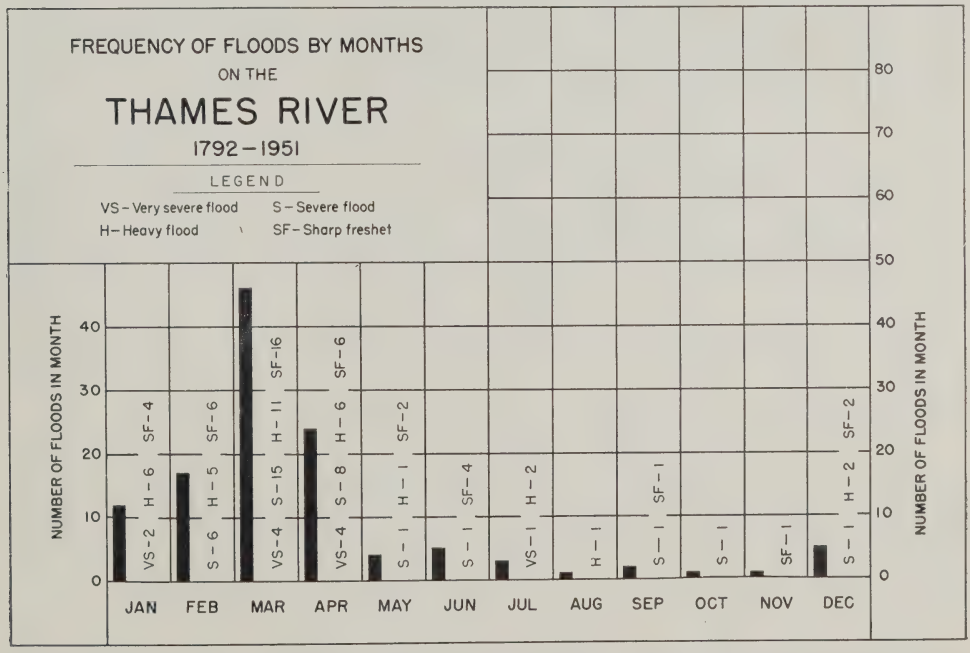
Nevertheless, it is not possible to make accurate comparisons with the records of the flood of 1937. Local conditions have changed too much in the interval. Taking into consideration, however, all the available information, it would appear that the flood of 1937 did not surpass all its predecessors to quite the extent that has been believed, except as regards the amount of damage to property.

Flood damage in London was very heavy. Nearly 8 per cent of the area of the city was flooded, 545 acres in all. The population of the flooded areas was 4,184 or 5.5 per cent of the total population of 76,424. By far the greater part of the 1,075 buildings affected were private houses, mostly of small or medium size.

From the information available the cost of damage to public property of various kinds may be conservatively estimated at more than $350,000, without reckoning the damage to railway property. The damage to private property cannot be easily estimated, but in the cities, towns and villages and their immediate vicinity it would appear to have been in the neighbourhood of $1,250,000. When the cost of the damage to farm property and the sums expended on relief and incidental expenses are added, the total cost of the flood of 1937 can have been little short of $2,000,000.



Only the most severe flood in each year appears on the chart. The lines show severity of flooding; not height of rise or volume of run-off.



Floods are shown in the month of their maximum severity. One or two early spring floods are omitted because the month of occurrence is not recorded.

The next two years produced no serious flooding, but in April, 1940, the river twice rose 15 feet above summer flow at Douglas Avenue in London. On the night of April 8-9, St. Marys was flooded almost as seriously as in 1937. Most of the stores in the business section suffered, but precautions reduced the damage to some extent. The ice had not yet gone out at Mitchell and this second rise caused alarm at London. Families moved out of London West and firemen were alerted for rescue work. Parts of Adelaide Street and of No. 4 Highway were under water. The ice did some damage at Mitchell, but elsewhere the expected rise did not take place and flooding on the rest of the watershed was not exceptional.

The April flood of 1947 was considered at the time to equal or surpass that of 1937. However, it was only below London that the water rose to near the same height. The flood may be said to have lasted from March 25 to April 9, at least below Thamesville; for, though there were distinct peaks, there was little relief for the flooded areas. The first rise at London on March 25 caused little flooding, but by the 28th there was high water at Chatham and wide flooding near the mouth of the river. By the 30th 5,000 acres were flooded in Dover Township. The flooded areas were increased by April 5, when there was 12 feet of flood water at Chatham and cellars were flooded. The village of Thamesville was completely flooded and reported 20 feet of water in the river. There had been flooding on both branches at London, at St. Marys and on No. 2 Highway near Delaware. The flood had not yet reached its height. Stratford was partly flooded on the 6th and the water at Douglas Avenue in London reached its peak of 20.8 feet above summer flow. West London was temporarily evacuated and the dikes reinforced with sandbags. The flooding here was not serious. It was rather worse in some areas on the South Branch. In all about 150 houses and some factories suffered serious flooding. The private loss did not approach that in 1937. The City spent $11,600 as a direct result of this flood and expended $86,069 improving the dikes and building new ones.

On the rest of the upper watershed the damage to private property was at least as great in 1947 as in 1937. Less public loss was reported, though the items obtained represent only part of the total. From Thamesville down the loss was probably greater in this flood. Some houses near MacGregor Creek in Chatham had four feet of water in their ground floors. The flooded area below Chatham was immense, highways were blocked, farmers were forced to move their families and stock and the spring plantings seriously delayed. Loss of soil by erosion, always serious in the floods of this region, was especially heavy. It seems likely that the total flood cost on the Thames amounted to more than $1,000,000, excluding the cost of the new dikes at London.

The flood of March, 1948, lasted about five days and repeated many of the details of 1947. The height of the rise was nowhere so great as in the previous April and the Thames Watershed suffered less than some other areas in Western Ontario. Nevertheless, the cost of the flood was probably equal to that of 1947. There was flooding at Mitchell, Stratford and St. Marys; at Woodstock, Beachville, Ingersoll and London; and from Thamesville to Chatham.

Heavy private loss was again reported from the Beachville area, but the flood appears to have been worse on the North Branch. Mitchell reported

$20,000 private loss and the damage to private property at St. Marys was above average.

During the past three years several freshets and floods have been reported from the Thames. None of these have been major floods, though the floods of December, 1949, and April, 1950, may be ranked as severe. A number of items of flood cost have been reported from different parts of the watershed, both public and private damage. No one freshet has produced a great amount of damage, but the totals are larger than might be supposed. There is fortunately evidence that the expenditures on protective works and the improvement of bridges, etc., are already reducing the amount of flood damage and it is to be hoped that before another major flood occurs on the Thames a large measure of flood control will have been established and that the long story of danger, inconvenience and loss may be brought to an end.

A table of recorded floods and freshets on the Thames for the period 1792-1950 will be found in the full Thames Report.

CHAPTER 3

POLLUTION

The Thames River system has a wide variety of uses. The watercourses function as drainage channels for agricultural land. They supply water for stock and in a few places for irrigation. The river may also be required to supply drinking water for municipal use and coolant and processing water for industry. It is expected to provide recreation facilities such as swimming and boating, and to supply a sustained annual yield of fish, and cover and food for wildfowl. Its valley should provide attractive scenery for parks and playgrounds. At the present time the river also has to dilute and remove large amounts of industrial wastes, milk wastes and both treated and untreated domestic and municipal sewage. The control of all these uses is, therefore, a very complex problem.

The chief sources of pollution are milk wastes, cattle droppings, sewage (both raw and treated), and various industrial wastes. Fibre, sawdust, and silt may also render the river bottom unsuitable for fish or unproductive of bottom fauna.

A full report on pollution on the Thames would require that the following work be carried out:

(a) Bacterial plate counts at all points suspected of bacterial pollution, and at regular space intervals in the river's course elsewhere;

(b) Measurement of the oxygen content in bacterially polluted sections and where industrial wastes enter the river, with additional measurements of the Biochemical Oxygen Demand below sources of industrial and bacterial pollution in order to estimate the rate of recovery of the river;

(c) Assessment of pollution sources.

Plate counts and B.O.D. measurements have already been made, both by the Provincial Department of Health and under the auspices of several cities

and towns on the river. An extensive bacterial survey has been made of conditions in and near the city of London. A survey of the chief pollution sources outside the city of London was therefore considered to be the most useful contribution which could be made in 1950.

1. AGRICULTURAL POLLUTION

Pollution from cattle was noted at 92 of 240 stations examined on the river during the wildlife survey. Severe pollution by cattle was found at 16 of the 240 stations visited. This condition was confined to the smaller tributaries, and agricultural pollution in general cannot be considered as severe in the watershed. Its elimination from the streams of Southern Ontario does not appear to be possible at the present time.

2. URBAN POLLUTION

Urban pollution includes the domestic sewage of all the large municipalities on the Upper Thames, together with wastes from commercial and industrial institutions in the urban areas, whether or not they are tied into any existing sewage facilities.

At the time of the survey (summer 1950) no municipality on the Upper Thames Watershed possessed adequate sewage disposal facilities. The cities of London, Woodstock, Stratford and Ingersoll all operate disposal plants, but in every case the facilities were overloaded, in need of repair or by-passed in some degree. None of the smaller towns or villages (Mitchell, St. Marys, Embro, Beachville, Dorchester, Tavistock) possessed sewage disposal facilities.

The stream most seriously polluted is the South Branch of the Thames. The sewage plants at Woodstock turn out an effluent that is little altered from raw sewage with most of the solids removed. The river receives a further load from a large creamery at Beachville. At Ingersoll it receives a further setback. It is very regrettable that the Ingersoll sewage plant, which is one of the most modern in Canada, was not designed to take the wastes from the creameries, cheese factories and other industrial plants in the town which still seriously pollute the river.

On the North Branch and its tributaries, industrial and sewage wastes reach the river at Stratford, St. Marys and Mitchell. The Stratford plant, when not loaded beyond its capacity, is capable of turning out a very clear effluent with a low oxygen demand, but the system is frequently overloaded. There are therefore frequently septic conditions in the Avon and this has interfered with the use of the water for agricultural purposes. Milk wastes increase the pollution lower down the Avon, but a heavy growth of green algae indicates a "recovery zone" reaching down to the confluence of the Avon and the Thames. Mitchell and St. Marys possess no sewage disposal facilities, so that effluents from industries (chiefly creameries) enter the streams directly. It appeared that at least a few domestic sewage outlets have been connected into the towns' storm sewers.

The city of London is potentially the most serious source of pollution on the watershed. Large-scale disposal facilities have been in operation for many years but these are now overloaded. In addition, a number of suburban establishments were not connected with existing disposal facilities at the time of the survey.

If present plans are carried through to completion London should cease to be a serious polluter of the Thames. A good deal of this work is now under way. Once London has cleaned up its own pollution problems it will be in a better tactical position from which to encourage other municipalities on the Thames River to follow its example.

3. SUBURBAN INDUSTRIAL POLLUTION

The most important stream polluters in the suburban areas of the watershed are milk-products factories. There are 24 milk-products factories scattered through the agricultural lands. Of the 24 factories, 14 lacked adequate facilities for dealing with fluid wastes. These 14, which are sources of pollution, are plotted on a map in the Upper Thames report of 1952.

In former times many cheese factories required the farmers who brought milk in for processing to take cans of the whey away with them. Nowadays few processing plants require this of their suppliers, and much whey flows off with the washing waters. Even without this additional load cheese washings contain about 20 per cent of the whey.

An efficient septic tank provides an adequate primary treatment for milk waste, but it must be of proper capacity. Where the dilution factor in the stream is large, secondary treatment may not be necessary. In other situations an efficient secondary treatment device such as a sand filter or a field-tile bed should be installed to treat the effluent from the septic tank.

4. POLLUTION CONTROL

From the point of view of municipal water supply there is at present no problem on the Upper Thames, since no water is at present taken from the river for drinking or culinary purposes.

While the Thames and tributaries are bacterially polluted at every large population centre which they encounter, the oxygen balance in the water is normally only locally upset. Both branches of the river are heavily polluted at London, and the river below London is also foul. The occasional presence of decomposing algae in the North Branch between London and St. Marys does not indicate the presence of much untreated sewage, since the effluent from treated sewage also permits the growth of algae.

The crux of the problem on the Thames is the question of other uses of water than for human consumption, such as for watering stock and for recreation, including swimming, and the production of fish. There is also the question of the foul smell and appearance of most polluted water, which are obnoxious to most people.

There are stringent requirements for purification of public swimming pools in Ontario, and these are strictly enforced in city swimming pools; but they are not commonly enforced in the rivers of the Province, although many rivers are intensively used on holidays by large numbers of people. Some extension of the present system of controls would be an advantage. The present legislation concerning pollution is both so general and so severe that in many cases it cannot be enforced without disrupting the economic life of the Province. Since the provisions are difficult to enforce, abuses are now common.

The solution appears to lie in defining more exactly the requirements of water purity, not only for public health, but also for industrial uses and for the propagation and protection of fish and wildlife. The State of New York provides an example of the machinery whereby this can be done. It has already:

(a) Set up a Water Pollution Control Board;

(b) Adopted a classification of waters for particular uses and a set of standards of quality and purity which are to be applied to them;

(c) Set up a permit system for control of all new outlets including those for industrial wastes.

A similar control of all new outlets in Ontario appears to be the logical first step. When and if it is completed, the second step of controlling the present outlets will have a greater chance of success, particularly if a set of water standards is established, based on the intended use.

The dams recommended for construction on the Thames would help to reduce the effects of the present pollution.

CHAPTER 4

UNDERGROUND WATER

1. GENERAL*

No consideration of river valley development, or of conservation, or of re-development of agricultural areas, could be adequate or in any way complete without some mention of that water which occurs beneath the surface of the earth, and particularly of that part of the subsurface water that is within the zone of saturation, the ground water. For it is this water that is primarily responsible for the continued flow of surface streams and that supplies, to a very great extent, our domestic and industrial needs.

The water in the atmosphere is perhaps primarily the concern of the meteorologist; that on the surface, of the hydraulic engineer; but that below the surface is directly the concern of the geologist, the agriculturist, and the engineer.

There is, in general, an upper limit within the earth's crust below which the permeable rocks are saturated; this upper limit is called the water table and it forms the surface of the zone of saturation. The water within this zone is the ground water.

*Caley, J. F. Underground Water Supplies. Department of Planning and Development Report, 1945.

Practically all the water recovered from the zone of saturation, that is, ground water, is derived from the atmosphere. Most of it reaches the earth in the form of precipitation, either as rain or snow. Of the precipitation falling on the ground, part is immediately carried away by streams as surface run-off, part evaporates, either directly from the surface and from the upper mantle of soil, or by transpiration of plants, and the remainder sinks into the ground ultimately to be added to the ground-water supplies.

The proportion of the total precipitation that sinks into the ground will depend largely upon the type of soil or surface rock and the topography of the area upon which the moisture falls; if the surface deposits are of sand or gravel more water will sink in than if those deposits were of clay; if the region is hilly and dissected by numerous valleys more water will immediately drain away than if the surface is fairly flat and but little dissected. Steady precipitation over considerable periods will furnish more water to the ground-water supply than will torrential rains; in this case the run-off may be nearly equal to the total precipitation. Moisture falling after the ground surface is frozen will not usually find its way below the surface and therefore will not materially replenish the ground-water supply. Light rains falling during the growing season may be wholly absorbed by plants. The quantity of moisture lost by direct evaporation depends largely upon temperature, wind and humidity.

That part of the precipitation that sinks into the ground finds its way downward until it reaches the ground-water level or until it comes into contact with a layer of rock which is impervious to its passage; such a layer may hold water some distance above the general ground-water level. This is known as perched water. If the ground-water level is at or near the surface there will be a lake or swamp; if it is cut by a valley, there will be a stream.

The conditions under which ground water occurs and the factors determining its quantity, quality, and possible recovery are many. This water is directly associated with the rock into which it percolates and as this rock may (and in South-western Ontario does) vary in its physical properties from place to place, so will the conditions affecting the ground water change.

Because of the large quantities of water that are daily consumed from underground sources, it may be thought that precipitation cannot furnish the entire supply. However, when it is remembered that a layer of water one inch deep over an area of one square mile amounts to about 14,520,000 imperial gallons and that in South-western Ontario the annual precipitation is perhaps in the order of 30 inches, it will be seen that over 420,000,000 gallons fall on each square mile each year. If we estimate that only 10 to 20 per cent (surely a conservative estimate) of the annual precipitation reaches the zone of saturation, there is still an appreciable quantity of water available to recharge the ground-water supplies.

It is not implied that the ground-water supplies are inexhaustible. So long as the annual recharge, that is the quantity of water reaching the zone of saturation, is equal to or greater than the quantity withdrawn, the ground-water supplies will not materially decline. Unfortunately, however, there are parts of South-western Ontario where this condition does not prevail. It is common knowledge that once permanent streams are now dry, that many springs have

disappeared and many wells have failed. Such a condition is in large measure the result of cutting down of forest trees, draining of swamps, and bringing into cultivation areas that perhaps should have been left as woodlots. In general, the same quantity of moisture is falling now as before the streams ceased flowing, but so far as ground water is concerned one of the most important results of the aforementioned conditions is the great increase in surface run-off, culminating all too often in disastrous floods and reducing greatly the quantity of water that formerly went to recharge the subsurface supplies. Couple with this the increase in population with its ever-increasing demand upon ground water for both domestic and industrial needs, and it is not difficult to see that the ground-water resources will still further decline unless some remedial measures are taken.

Getting back to the geology of ground water; all sedimentary rocks are to some degree porous, that is, they possess pores between the individual grains of which they are composed. Water stored within the rocks mainly occurs as filling these spaces. A very fine-grained rock containing water may have such small pores that the attraction between the rock and water is great enough to hold the water in the rock; such a rock will not yield its water to wells. Those rocks that yield their water readily are called aquifers; those that do not are impervious beds.

For the present purpose the geology of South-western Ontario may be divided into two parts; the bedrock and the overlying unconsolidated glacial deposits.

The bedrock consists of layers of limestone, shale and sandstone that, when viewed at an isolated outcrop, generally appear to be flat-lying, but that regionally are known to dip from 10 to perhaps 40 or 50 feet a mile in a general south-westerly direction. These rocks are sedimentary in origin, having been formed from sediments deposited in bodies of sea water later to be consolidated into hard rock.

The water-bearing properties of the various types of rock constituting this sedimentary succession vary greatly. In general, the shales, being fine-grained, are the poorest aquifers, while the sandstones and limestones are considerably better.

No special study of the water in these rocks has been made, but they have been mapped over much of South-western Ontario so that the distribution, thickness, and general physical characters of the several formations are fairly well known. In the area bordering Lake Erie, the bedrock has been penetrated to various depths by wells drilled for oil and gas, and a study of these drilling records has yielded some general data regarding water. Thus it is that we know of occurrences of fresh water generally in the upper part of the bedrock; of sulphur water somewhat lower; and of salt water at still lower depths.

Overlying the bedrock is the glacial drift. During the final stages of geological history great accumulations of ice formed at several centres in Northern Canada. Due to the pressure exerted by the immense thickness of ice, the ice moved out in all directions from these centres, covering large areas with a continental ice sheet. As the ice advanced it picked up great quantities of loose rock which it carried along and which was deposited when the ice finally re-

treated by melting. This material is unconsolidated and called glacial drift. Several advances and retreats of the ice sheet took place and each retreat left its accumulation of drift on the surface over which it passed.

Thus, over most of South-western Ontario the bedrock is covered with drift ranging in thickness from zero in parts of the Bruce Peninsula to over 600 feet in the region north of Toronto.

Generally, the drift consists of boulders and pebbles of various composition and size embedded in a matrix of clay to form a more or less impervious mass called boulder clay. Intermingled with this, and commonly in a most complex manner, and also lying above, below, and between successive tillsheets are beds, lenses and pockets of waterlaid sand and gravel which form the chief water-bearing members of the drift.

Throughout the greater part of South-western Ontario most of the ground-water supplies are directly associated with the glacial drift.

2. FARM WATER SUPPLY

A survey of farm water supply on the watershed of Trout Creek and a portion of the watershed of the Middle Branch of the Thames was begun in the middle of October, 1945. Two hundred and eighty-seven reports were obtained from farmers in the Trout Creek area—about 95 per cent of the occupied farms. A number of other farms were visited where reliable information could not be obtained owing to the absence of the owners. Whenever possible in these cases information was obtained from neighbours, but this could not always be done. Heavy snowstorms in December interfered with the work by closing some of the side roads with drifts. It was not possible to complete the survey of the Middle Branch above Embro, as was intended. Over one hundred reports were collected from this area, however, and it was covered sufficiently to indicate that conditions here are very similar to those in Trout Creek. The area on the Middle Branch affected by the lowering of the underground water supply which appears to have taken place in the last 50 or 60 years is perhaps slightly greater in proportion than that on Trout Creek. The farms reporting shortage of water lay mostly along the divide between the watersheds.

Of the 357 wells on which reports were obtained, 266 were dug wells. These wells vary greatly in depth, the average for the watershed being 22 feet. They can be divided into two general classes—the ordinary dug wells, usually more than 20 feet deep, in which the depth of water varies with the amount of precipitation, and the shallower wells, called by their owners "spring wells", in which there is a fairly constant level of water at from 2 to 4 feet. Very few shallow wells wholly dependent on surface seepage were reported on the watershed.

The first of these types of dug well was, in former times, the most usual source of water supply in the area. Many of these wells have been replaced by drilled wells of some form, and others, all over the watershed, were reported as going dry periodically. Some of these have been giving so much trouble that the owners were drilling new wells when visited or intended to do so as soon as possible. Speaking generally, it may be said that wells of this type, less than

30 feet in depth, are no longer satisfactory for watering stock or as the only supply. Very frequently a well about 20 feet in depth and curbed with stone was still in use for domestic supply; while the well used for the stock was from 10 to 20 feet deeper and curbed with brick, indicating that it had been constructed at a later date than that at the house. When some kind of mechanical pumping system has been installed on the deeper well, the house well has often gone out of use altogether. These disused wells are not included in the table at the end of this chapter.

In many places it has been found necessary to dig to a greater depth to obtain a satisfactory supply. Wells of from 40 to 60 feet are not uncommon, and even greater depths are found occasionally. Two wells 90 feet deep were reported. One of these was an exceptional case, the well having been dug deeper, after water had been found, to avoid quicksand. The other 90-foot well formed part of a group of deep wells in Lots 33-35, Concession VII-VIII in Zorra West. This group of four wells included one of 47 feet, one of 50 feet and one of 87 feet, besides the 90-foot well already mentioned. As a rule, all the deeper wells were giving a good supply of water.

The wells reported as "spring wells" were usually giving a satisfactory supply. They were often found in the neighbourhood of flowing springs and in many cases such a spring was used as a supplementary supply. They were usually said to have a constant depth of a few feet of water and when it was reported that they could be pumped dry it was almost invariably added that they filled up again in a few hours. A few of these wells were reported as overflowing.

A number of farms on the watershed depend on springs for their whole water supply and others use the springs to a greater extent than their wells. There are groups of strong springs used for this purpose along the valley of Trout Creek from Harrington to St. Marys, and others are found in the Gore of Downie, near Harmony, on the Stratford-Embro road, and in the neighbourhood of Fairview. In a few cases there were reports that the springs were giving less water of late years or even going dry. These were always springs that were being used in addition to wells. In one of these cases it was believed that planting had materially improved the flow.

A few small ponds were being used for stock. As these were, in every case, fed by springs and of small area, they are included with the springs in the table of Farm Water Supply. One or two farmers reported that their cattle used kettle ponds to drink from in pasture.

The impressions received from this survey are that the Trout Creek Watershed as a whole is well supplied with water under present conditions, that there was a marked tendency to shortage in many parts of the watershed about forty years ago, which led to extensive deepening of wells and drilling for water; and that shortage of water is felt at the present time in scattered localities, particularly in winter.

There seems to be good reason to connect this lowering of the ground water after 1900 with the cutting of many of the woodlots which had survived until about that time. The effect of under-drainage on the water supply is less

certain, but the belief is widely held that this has a great deal to do with the failure of some of the wells. The present shortage is attributed in part to more stock being kept. Modern practices also involve a larger consumption of water per head of stock than was the case in the past. When "spring wells" are used, on the other hand, it has often been found that modern water systems which draw evenly on the water supply are more satisfactory than the old method of pumping up large quantities two or three times a day.

Conservation measures in general would certainly have a beneficial effect on the farm water supply of the area. But, as the shortage is more acute on the higher ground, the restoration of woodlots and the protection of kettle areas, whether ponds or swamps, would seem to be more important in this respect than other measures which are concerned rather with the valleys than with the tableland itself.

FARM WATER SUPPLY ON THE TROUT CREEK WATERSHED

Townships	Creeks*	Springs	Dug Wells	Drilled Wells	Wells Sometimes Dry	Wells Giving Good Supply
Easthope S.	9	4	83	10	33	60
Downie	27	22	80	21	22	79
Blanshard	6	4	12	14	2	24
Nissouri E.	13	10	26	22	6	42
Zorra W.	29	36	65	24	23	66
Totals	84	76	266	91	86	271

*Used for watering stock.

CHAPTER 5

HYDRAULICS

1. GENERAL HYDRAULIC PROBLEMS

Hydraulics as applied to conservation deals with the measurement and control of run-off from river drainage basins. Measurement has to do with such factors as precipitation—both rain and snow—the topography and vegetative covering of the area and the daily gauging of the flow of the river at selected points. Control deals with the prevention of floods by the use of reservoirs and other structures, and the increase of summer flow.

Floods which are caused by the natural run-off from river basins have occurred from time to time in Southern Ontario ever since records were first kept. Evidence of these can be found in diaries going back well over 150 years and from newspaper records for at least 100 years. Most of this run-off occurs in the spring, with the result that there is too much water in our rivers at the time of the year when it is needed least and very little, if any, during midsummer when it is required most. In addition to the flooding which is caused by spring run-off, occasional floods also occur during the summer on watersheds which

have little natural protection. These summer floods do serious damage to crops. Such floods are not confined to a few of our largest rivers, but records show that all rivers of any consequence have from time to time caused serious damage in this way.

When Ontario was mostly covered with forest and the natural reservoirs, such as large swamps, had not been interfered with, severe flooding probably was not as frequent as it is today because these two factors had an ameliorating effect on the flow of water. Land clearing and drainage were necessary to open up the country for agriculture, but in some respects these were carried beyond the point of necessity, thereby aggravating the flood situation. In order now to regain a more or less stable condition of the rivers and streams, certain conservation measures must be carried out, such as the reclaiming of large swamps and water storage areas, the reforestation of marginal and submarginal land, and also by a program of proper land use as indicated by farm planning, whereby run-off from gently sloping land can be controlled by such methods as contour cultivation and grass land where such is indicated. Such methods aim to control water where it falls on the land. If this could always be done it would be the ideal solution of the flood problem. But to reduce the required flood storage in a large watershed, a program of improved land use would need the co-operation of a great many individual farmers. This would take many years to accomplish. More immediate measures are therefore also necessary, especially where urban centres are frequently flooded.

One of the first problems facing the hydraulic engineer is to estimate or measure the run-off from a drainage basin which causes flooding farther down the valley. This includes a careful examination of rainfall over the years at different times of the year, which in turn presupposes that weather stations have been established in the area. Topography, types of soil, the amount of vegetative covering, particularly tree growth, on the area, and the gradient of the river, which has a bearing on the rapidity with which the water travels to the river's mouth, must all be carefully studied. If no gauging stations have been established then the run-off must be computed by taking the above factors into consideration and an approximate figure of flow is then determined by comparison with a neighbouring drainage basin which has gauge records in order to decide how much protection by the use of reservoirs is required. If, on the other hand, gauges have been established, by which a daily record is kept of the amount of water going down the channel at certain points, then a more accurate determination can be made of how much protection is needed. Fortunately, at London on the North and South Branches of the Thames there are hydrometric records dating from 1915, and at other stations on the watershed for shorter periods, and although the years of records for the latter are short they may be correlated with the long-term records and usually dependable run-off ratios established.

After the amount of run-off has been measured by whichever means are available to the engineer, it will give him a figure of flow which will indicate how much of this water will have to be held back by different methods in order to give the necessary protection where flooding is taking place. This means that a reconnaissance survey of the whole watershed must be made in order that suitable valleys be selected where dams can be built for the storing of the

required amount of water. When more than a sufficient number of such reservoir sites have been selected, each must be measured as to its capacity, and the required number chosen to hold back sufficient water to solve the flood problem. In addition, wherever a dam is to be built, some subsurface exploratory work must be done at the site to make certain that the dam will have a proper foundation. Only after this preliminary work has been carried out can the reservoirs be finally chosen, the actual designing of the dam structures undertaken and the work carried through to completion.

While conservation reservoirs are usually built for the purpose of preventing floods, they are needed just as much in Southern Ontario for increasing summer flow. This has become increasingly important in recent years because rivers with extreme low flow and those which dry up entirely are a health menace to the communities through which they pass. Summer flow is necessary for flushing out the channel; to furnish water for industrial plants; for the practice of good agriculture; and is absolutely necessary for dilution where urban municipalities empty the effluent of their sewage disposal plants or raw sewage into the river.

The building of dams for the prevention of flooding and the increasing of summer flow is a comparatively new concept in engineering. It is only since the turn of the century that structures of this kind have been used for this purpose in North America. The older methods included such projects as the straightening and widening of the river, increasing the span of narrow bridges, and the elimination or improvement of other man-made works which might obstruct the flow or cause ice jams. Also, occasionally, for such work a river was diverted into another watershed, or dikes were built to hold it within its banks. Such practices are aimed at one thing only, namely to get rid of water as quickly as possible. They do not take into consideration the necessity of holding water at the headwaters for deep infiltration or retaining it for summer flow throughout the year. On some rivers in Ontario channel improvements, diversions and even dikes must be built, especially where dams and reservoirs are not economical and summer flow is not a major problem.

2. THE UPPER THAMES WATERSHED

(a) GENERAL DESCRIPTION

The Upper Thames Watershed comprises the drainage area of the Thames above the confluence of Dingman Creek with the main river ten miles southwest of the city of London. It measures 51 miles in length (north and south), has a maximum width of 37 miles, an average width of 26 miles and an area of 1,324.9 square miles. The watershed is drained by two main branches and their tributaries, known as the North Branch and the South Branch, their confluence or "the Forks" being near the south-westerly limits of London. The Middle Branch is a major tributary of the South Branch, its confluence being approximately 16 miles above the Forks at London. Major tributaries of the North Branch are the Medway River which joins the North Branch about three miles above the Forks, Trout Creek which joins the North Branch at the town of St. Marys and the Avon River which joins the North Branch about four miles above St. Marys.

The rate of run-off* into these rivers and their tributaries is very high; so much so that the banks in places are unable to contain the flood waters and the low areas are flooded. Floods may occur at any time of the year but it is the floods which occur during the spring break-up that are frequent and most severe, and it is these floods which are the concern of this report.

(b) CAUSE OF FLOODS

The topography, soils and other natural features of the watershed contribute in a great measure to flooding. The impervious clay soils, the high gradient of the river bed, and the steep lateral slopes of the tributaries increase the rate of run-off. There are no lakes or swamps which have been left untouched to serve as natural reservoirs; also, a high percentage of the forest has been removed. In addition there is a network of municipal drains above London which includes the straightening and widening of smaller creeks. These works undoubtedly increase the rate of run-off and aggravate floods.

The above adverse physical conditions are constant, but the magnitude of spring floods depends largely upon precipitation and temperature and the condition of the ground, that is, whether it is saturated or frozen. The depth and weight of the snow pack and the direction and the velocity of wind are also important factors. The most adverse combinations of factors, however, for a spring flood are frozen or saturated soil covered with a heavy snow blanket, accompanied by heavy rain and unseasonable prolonged high temperatures. Such floods may be further aggravated by ice jams impounding large volumes of water which, when the jams break, surge down and boost the flood peak.

The towns and cities subject to serious floods are London, St. Marys, Mitchell, Woodstock and formerly Ingersoll, now relieved by channel improvement.

(c) REMEDIAL MEASURES FOR FLOOD CONTROL AND LOW SUMMER FLOWS

Of the above places subject to floods, London has sustained the greatest damage. Owing to its location at the Forks, it is in the most vulnerable position on the river, consequently in planning the location of required storage this fact has been kept in mind; but at the same time requirements for the safety of smaller municipalities up stream have not been overlooked. Low summer flows in both branches of the Thames are also a major problem and measures for both problems are complementary.

The land use and reforestation conservation measures recommended in this report are an essential part in any plan for flood relief and increasing low summer flows, but of themselves, even though immediately implemented, would not be sufficient to solve either problem and must be supplemented by storage of water in conservation reservoirs up stream which will reduce the flood crests to a safe stage, and later during dry periods may be released to increase the low flows.

Dikes and channels are aids only to a flood problem and should be considered as expedients. The benefit is local and they do not conserve water but

*Run-off is the amount of water that the drainage area supplies to the open streams and is the excess of precipitation over evaporation, transpiration and deep seepage.

have the reverse effect of speeding flood waters past the trouble area and often aggravate flooding down stream. Some diking and channel work, however, is necessary on the Upper Thames in conjunction with reservoir control when sufficient storage is not available or is too costly.

3. THE SOLUTION OF THE FLOOD PROBLEM

(a) FUTURE FLOODS

The flood which caused the most damage, at least in recent years, occurred in April, 1937. The exceptional flood flows on the South Branch were an all-time high, but on the North Branch the highest flood flows actually occurred in 1947 and would have caused greater damage in London had the South Branch been correspondingly high and had not part of the dike system been raised and extended after the 1937 flood. From these floods it will be seen that, in order to give protection for the future, provision must be made not only for floods of known magnitude but for greater ones which in all likelihood will occur during the years ahead.

It is difficult to state with accuracy what these greater floods might be, but in planning protection for the municipalities of the Upper Thames it has been considered sufficient to provide for protection equal to one-third more than the greatest known flood of the past, namely the flood of the South Branch in 1937 and the flood of the North Branch in 1947 if they should occur together. This was the factor of safety provided by the engineers who prepared the official plan of the Muskingum Conservancy District. Such a probable flood of the future is termed an hypothetical flood and will be referred to as such hereafter in this report.

(b) STORAGE REQUIRED

The flood control storage required for the hypothetical spring flood for the North Branch is 80,734 acre feet* and for the South Branch, 30,346 acre feet. The total for the Forks at London is 111,080 acre feet. The plan is designed for such operation that all the reservoirs would be filled to spillway level but not beyond, in the case of a spring run-off with a magnitude equal to the hypothetical flood. During such a flood the outflow from the reservoirs, including the run-off from the uncontrolled areas below the reservoirs, would not exceed the safe carrying capacity of the channels below. Should the hypothetical flood be exceeded in magnitude, then the reservoirs would have to discharge the flood waters at a greater rate than planned and there would be some flooding.

(c) DISTRIBUTION OF STORAGE

The distribution of the 111,080 acre feet of storage should be as near as possible to the ratios of the spring run-off volumes of the tributaries above London. This ratio is 73.77 per cent or 81,944 acre feet for the North Branch and 26.23 per cent or 29,136 acre feet for the South Branch.

*An acre foot is a volume one acre in area by one foot in depth and is equivalent to 43,560 cubic feet.

The North Branch is well provided with reservoir sites. The chosen sites are well located strategically and their storage capacity is in fair proportion to their respective drainage areas. The South Branch, however, is not so well favoured with reservoir sites. The Thamesford site on the Middle Branch* is the only one which has a capacity comparable to those of the North Branch. The other two sites are small and alone are inadequate for the protection of Woodstock. Also over half of the South Branch drainage area is uncontrolled. There is, however, sufficient storage in the South Branch, as the amounts below indicate.

Reservoir storage available in North Branch.....	80,734 ac. ft.
Reservoir storage available in South Branch.....	30,346 ac. ft.
Total.....	111,080 ac. ft.

The uncontrolled area of the North Branch is 97 square miles or 14.76 per cent of the North Branch drainage area. The uncontrolled area of the South Branch is 277.9 square miles or 53.55 per cent of the South Branch drainage area.

(d) LOW AND INCREASED SUSTAINED FLOWS

Reservoirs which are used for the storage of water for summer flow, as well as for flood control, may be regulated for the summer months only, which would yield more flow during this shorter period; or, preferably, extended over the balance of the year in order to dilute the effluent from domestic sewage and industrial waste. May is usually a wet month and the reservoirs would be full on June 1, and about that time storage would be used to increase low flows. June 1 to September 20—112 days—constitutes a summer period. June 1 to March 1—273 days—covers a yearly period, March 1 being about the time of the break-up, when the reservoirs would shortly be filled again.

The summer of 1939 and the winter of 1940 was the driest yearly period since 1915. The driest summer period was in 1936, the mean monthly flows at London on the North Branch being only 12 c.f.s. in August and on the South Branch being only 22 c.f.s. in July. The mean daily flows were even lower, being 9 c.f.s. for 9 days of the month on the North Branch and 12 c.f.s. for 4 days of the month on the South Branch. Conservation reservoirs will correct this adverse condition as may be seen in Table H-A below. All reservoirs may be used for summer flow except Fanshawe.

It may be pointed out here that the Thames below London will benefit not only by the increased flow but also from the greatly reduced flood crests as well. The proposed reservoir system will control the run-off from 802 square miles or approximately 36 per cent of the entire Thames Watershed area and would be invaluable at such times when the lower Thames River alone was in flood, as in January, 1951. Under these conditions the flow from above London could be reduced to the minimum and held until the flood danger below had passed.

*A tributary of the South Branch.

UPPER THAMES RIVER WATERSHED

SHOWING

CONSERVATION RESERVOIRS AND CHANNEL IMPROVEMENTS

LEGEND

RECOMMENDED RESERVOIRS
OTHER RESERVOIRS SURVEYED
CHANNEL IMPROVEMENTS
GAUGING STATIONS
PLACES SUBJECT TO SEVERE FLOODING

SCALE of MILES

2 1 0 2 4 6 8

TABLE H-A

SUSTAINED FLOWS AT LONDON BY THE REGULATION OF CONSERVATION RESERVOIRS—(FANSHAWE EXCEPTED)

Branch	Period of Days	Average Daily Discharge from Reservoirs—Conservation Storage Only		Sustained Flows at London	
		Driest Year on Record c.f.s.	Average Year c.f.s.	Driest Year on Record c.f.s.	Average Year c.f.s.
North	112	150.2	152.4	201.3	325.5
South	112	87.6	89.1	161.5	277.5
North	273	60.0	61.3	128.4	455.6
South	273	33.8	33.9	104.2	263.4

(e) PROPOSED DAMS AND RESERVOIRS

(1) FANSHAWE

The Fanshawe Reservoir is located on the North Branch of the Thames 5½ miles north of the city of London.

The dam will be of the gravity earth-fill and concrete type. The concrete spillway section will be 250 feet long, 100 feet high (above bedrock) and 115 feet wide at the base. The spillway will be fitted with two 6-foot diameter controlled discharge tubes and six 30 feet by 30 feet spillway gates and have a discharge capacity in excess of 100,000 c.f.s. at maximum water level. In addition the necessary water intake tubes and pumping equipment will be installed in order that the reservoir may be used for domestic water supplies for the city of London.

The earth embankments which will join the concrete section to the valley slopes and complete the barrier will have a minimum top width of 44 feet with 3 to 1 and 2 to 1 slopes on the upstream and downstream sides respectively. Total length of the completed structure will be 2,050 feet.

The reservoir when full (elevation 890 feet) will have a water surface area of 1,322 acres, extend northerly for approximately 7 miles, with a maximum depth of 71 feet at the dam and a storage capacity of 38,880 acre feet. At the proposed recreational lake level (elevation 860 feet) the reservoir will extend northerly for a distance of 4.4 miles, with an average width of ¼ mile and a maximum width of ½ mile just north of the dam. The water surface area will be 645 acres and it will have a volume of 10,040 acre feet.

The estimated cost of the dam and reservoir including a 24-foot roadway across the top of the dam is $4,711,250.

(2) GLENGOWAN

The Glengowan site is located on the North Branch of the Thames, three miles north of the town of St. Marys. The dam will be the same type as the

Fanshawe Damsite, Summer 1947—looking upstream from road between Cons. III and IV London Twp.

Glengowan Damsite—from bridge on Lot 7 Con. XV Blanshard Twp. Broken white line in this and following photographs indicate (approx.) the crest of the proposed dam.

Fanshawe, consisting of a concrete spillway section and earthen embankments. The spillway section will be 280 feet long and will be fitted with five sluiceways and six Taintor type gates each 8 feet high by 40 feet in length. The over-all length of the dam will be 1,200 feet with a maximum height of 64 feet above the bed of the river.

The reservoir, when full, will have a maximum depth at the dam of 59 feet, and the lake would extend northerly for a distance of about 8.7 miles with an average width of about ¼ mile and a water surface area of 1,195 acres. With a reservoir capacity of nearly 27,000 acre feet it will provide protection to St. Marys for most flood years and would benefit all the municipalities down stream by reducing the high spring flows and providing increased summer flow.

The total estimated cost of this dam and reservoir, including a roadway over the dam, is $2,020,000.

(3) WILDWOOD

This reservoir is located on Trout Creek near Highway No. 7. The proposed dam would be of the same design as the original one prepared for this site except that the height would be increased from 41.0 feet to a height of 53.0 feet above the bed of the stream. The reservoir would extend south-easterly for a distance of 6.2 miles with an average width of 1,170 feet and a surface area of 880 acres. The maximum holding capacity would be 14,900 acre feet as compared to 6,400 acre feet for the original dam.

This dam would also be of the earth-fill and concrete type and would be fitted with five gate-controlled rectangular orifices and 108 feet of free overflow section to provide satisfactory regulation of the discharge from the dam at all times.

The estimated cost for the larger dam and reservoir is $1,407,000.

(4) THAMESFORD

The Thamesford Reservoir site is located on the Middle Branch two miles north of the village of Thamesford. The site is suitable for a dam 49.5 feet in height which would provide 17,500 acre feet of storage. Such a dam would create an artificial lake 6.4 miles long with an average width of 1,550 feet, a surface area of 1,200 acres and a maximum depth of water at the dam of 43.5 feet.

The estimated cost of the dam and reservoir based on an assumed depth to rock of 25 feet is $2,440,000.

(5) WOODSTOCK

This dam and reservoir would be located on the South Branch immediately north of the city of Woodstock, about ½ mile east of No. 19 Highway. It would be 31 feet in height. The reservoir would extend north-easterly for a distance of 4.5 miles, with a width of about 1,050 feet, a surface area of 575 acres and a maximum water depth at the dam of 25 feet. The capacity would be 5,152 acre feet, and being situated so closely to the trouble area it could be used to full advantage during the critical periods of high flow.

Wildwood Damsite—looking upstream from No. 7 Highway 2 miles east of St. Marys.

Thamesford Damsite—panorama of the proposed site 2 miles north of Thamesford Lot 5 Con. XI Nissouri E. Township.

This reservoir is ideally located for a recreational lake and if it should be required for this purpose at some future date the conservation storage so lost could be replaced by constructing one or two small dams farther up stream.

The estimated cost for this dam and reservoir is $760,000.

(6) CEDAR CREEK

The dam for this reservoir would be located on the Cedar Creek 1½ miles south of the city of Woodstock and would be the smallest dam in the proposed reservoir system.

At full capacity it would have a water surface area of 1,460 acres and would be the largest of any of the proposed reservoirs in this respect. A large part of the flooded lands is swamp which has little value except for storing water.

This reservoir would have a storage capacity of 7,728 acre feet with a maximum depth of water at the dam of 21.5 feet. With this amount of storage, this project, in conjunction with the Woodstock Reservoir and Channel Improvement, would provide the needed protection for Woodstock and also provide a valuable increase for the much needed summer flows in the South Branch.

The estimated cost of this dam and reservoir is $604,000.

(f) OTHER DAMS AND RESERVOIRS

Eight reservoir areas were surveyed in the watershed, of which six have been selected to make up the reservoir system for flood control and water conservation storage. The two remaining sites, namely Medway and Fish Creek, are good sites and are the only remaining ones where sufficient storage capacity may be had to make the construction of a dam economically feasible. These sites should be held in reserve in the event that some unforeseen conditions make the provision of additional storage in the system advisable or necessary.

Table H-B gives the data and costs for all the dams and reservoirs included in the proposed scheme.

TABLE H-B

DAM AND RESERVOIR DATA

Name	Dam		Reservoir				Cost
	Length (Ft.)	Height (Ft.)	Length (Miles)	Av. Width (Ft.)	Area (Acres)	Capacity (Ac. Ft.)	$
Glengowan...	1,200	64.0	8.7	1,132	1,195	26,954	2,020,000
Wildwood...	1,790	50.5	6.2	1,170	880	14,900	1,407,000
Fish Creek*..	980	41.0	7.7	1,054	984	11,753	—
Fanshawe...	2,050	77.0	7.6	1,469	1,351	38,880	4,711,250
Medway*....	950	76.0	5.2	1,560	983	21,507	—
Woodstock...	1,440	31.0	4.5	1,052	575	5,152	760,000
Cedar Creek.	1,100	27.5	5.5	2,185	1,459	7,728	604,000
Thamesford..	1,200	49.5	6.4	1,548	1,200	17,466	2,440,000
Totals.....	.....	.....	.....	.....	.....	111,080	11,942,250

*Surveyed but not included in scheme

Woodstock Damsite—panorama of the proposed site immediately north of the city, Lot 21 Con. II Blandford Township.

Cedar Creek Damsite—looking downstream from bridge on road between Cons. II and III Oxford E. Township.

(g) CHANNEL IMPROVEMENTS

(1) INGERSOLL

In addition to the two conservation reservoirs which are proposed for the South Branch of the Thames River, an extensive channel improvement scheme has already been completed. This is located in the Beachville-Ingersoll area and is known as the Ingersoll Channel Improvement Scheme. This work was done to provide immediate flood protection for the town of Ingersoll and the industrial plants and quarries located in the river valley above Ingersoll.

Starting at the village of Beachville the improved channel section parallels the Canadian Pacific Railway line along the southerly side of the valley to the easterly limit of Ingersoll. From this point the new channel follows, in general, the natural river course except for the wide loops below Ingersoll which it cuts through.

The new channel was designed to carry a flow of 8,000 c.f.s. and will safely discharge momentary peak flows as high as 11,750 c.f.s., which provides protection against such floods as have occurred in the past.

The cost of the work, including a new bridge, was $1,000,000.

(2) ST. MARYS

The overall water conservation plan for the Upper Thames Watershed provides for the construction of two storage reservoirs above St. Marys (Glengowan and Wildwood) with a combined storage capacity of 41,854 acre feet of which 38,854 acre feet would be available for flood control purposes. This amount of storage would provide protection from floods such as have occurred in the past but would not be sufficient for the hypothetical flood; consequently some channel improvement would be necessary to supplement the storage and satisfy the flood problem.

It is estimated that the present channel through St. Marys can only accommodate flows up to 10,400 c.f.s. and still provide a margin of safety. To reduce the hypothetical maximum mean daily flow to this stage would require 57,300 acre feet of storage or 18,400 acre feet more than is available in the proposed Glengowan and Wildwood Reservoirs. Thus to give full protection to St. Marys additional storage or an increased channel capacity is necessary. The additional storage could be made available by constructing a third dam above St. Marys but in view of the fact that the present proposed storage is sufficient for the overall flood and low flow problems it is believed that the channel improvement offers the better solution. Further, in order to make full use of the channel capacity at London and to be able to route the flood waters to the best advantage, St. Marys should be able to discharge its proportion of channel capacity flow or at least 12,100 c.f.s. This flow is 1,700 c.f.s. more than the present channel can safely handle and thus some channel work would be required in any case.

Flood relief for St. Marys is an urgent matter and, as it would probably be some time before the reservoir system would be in operation, it is recommended that the channel improvement work be extended to provide protection against floods up to the magnitude of the 1937 flood or a flow of 20,000 c.f.s. However, in recommending this amount of channel improvement two facts have

St. Marys Dam—present dam has not sufficient spillway capacity to discharge the high spring flows safely.

Queen St. Bridge—limited opening of this bridge further aggravated the flood conditions.

River channel north of Park St.—shoals and weedy condition of the stream bed also tend to impede the normal passage of the spring flows.

been kept in mind. Firstly, that this work is only a temporary measure to provide some immediate relief for St. Marys and the amount of work has therefore been kept to a minimum wherever possible in order to avoid unnecessary expenditures. Secondly, that the pond behind the present dam has a certain aesthetic and recreational value and the proposed work has been designed to leave most of the dam intact so that the pond may be retained.

The estimated cost for this channel improvement is $135,000.

(3) MITCHELL

While flooding is the major problem at Mitchell and the immediate objective is to control the high spring and flash summer flows, any remedial measures which do not provide for an increased summer flow could not be considered to be complete.

Conservation storage reservoirs would satisfy both phases of this problem. Unfortunately, there are no reservoir sites of economical size available above Mitchell. The present dam at Mitchell could be raised five feet and the pond area dredged to contain some 1,200 acre feet of storage, which would ease the flooding somewhat and provide means for a definite improvement in the summer flow.

This amount of storage situated so close to the trouble area would be invaluable in times of flooding but would not be nearly enough to give complete protection against even such floods as have occurred in the past. Thus other supplementary works are necessary. The required protection could be had by either increasing the channel capacities of the streams through Mitchell or by diverting the Whirl Creek flow around the town. Of these two methods the channel improvement is the better and is the one recommended.

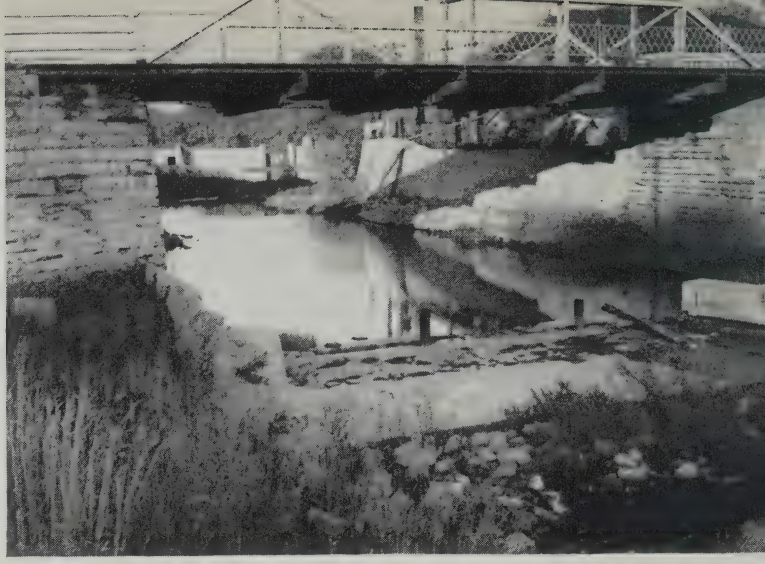
The channel improvement work would consist of removing obstructions such as islands and shoals, deepening, widening and straightening the river channel from the dam to a point about one mile below the town. In addition, a concrete wall would be built at the Flax Mill to protect the mill building and the No. 8 Highway bridge would be replaced by a new bridge with a clear span of 75 feet. Whirl Creek channel would be aligned at its confluence with the main river to allow the two flows to come together smoothly, thus permitting a freer passage of the flood waters at this point and minimizing the backwater effect.

The additional storage being provided at Mitchell will more than compensate for the water which will be hurried through by the improved channel section and should prevent any appreciable increase in the flood flows below the town, and the increased summer flow which would be made available would benefit many along the river from the dam on down.

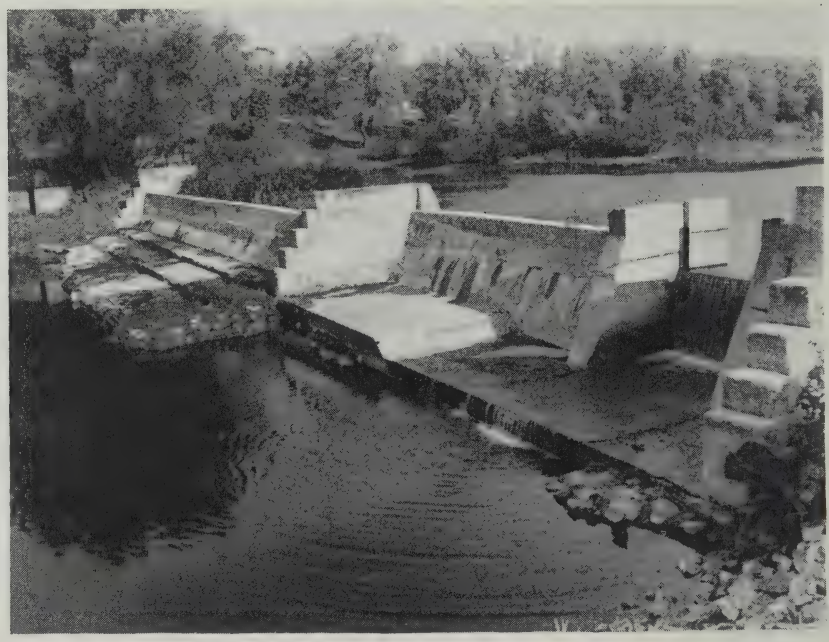
The estimated cost of the dam and channel improvement is $260,000.

(4) WOODSTOCK

Flooding at Woodstock is caused by solid limestone rock shoals, which in places rise in the river bed, from Dundas Street for nearly a mile down stream. The shoals choke the flood flows and cause a backwater on the Thames River



Highway Bridge at Mitchell—a new bridge with a 75-foot clear span would be erected here.



Mitchell Dam. This dam would be removed and replaced by a dam 5 feet higher.

Looking downstream from the dam—the river has been confined to its low-water channel by buildings, retaining walls and narrow bridge openings.

and up Cedar Creek where most of the damage occurs. Even with the shoals removed the channel is not large enough to contain major floods, but their removal, together with the Woodstock and Cedar Creek reservoirs, will provide protection against a flood of the hypothetical magnitude.

A channel capacity of 1,355 c.f.s. requires 18,300 acre feet of storage above Woodstock for the hypothetical flood. The two reservoirs shown below and recommended elsewhere in this report provide the following storage:

Woodstock Reservoir	5,152 acre feet
Cedar Creek Reservoir	7,728 acre feet
Total storage	12,880 acre feet
Storage required	18,300 acre feet
Storage deficiency	5,420 acre feet

With both reservoirs in operation the 5,420-acre feet storage deficiency would require a channel capacity at the confluence of the South Branch and Cedar Creek of 2,000 c.f.s. for the hypothetical flood and it is proposed to excavate and grade the river in order to increase the channel capacity from 1,355 to 2,000 c.f.s.

The cost of this work is estimated at $75,000 if completed during a period of low water.

TABLE H-C

CHANNEL IMPROVEMENT DATA

Name	Length Feet	Bottom Width Feet	Cost $
Ingersoll	32,725	60 to 90	1,000,000
St. Marys	5,960	150 to 225	135,900
Mitchell	7,500	60 to 160	260,000*
Woodstock	5,900	55 to 69	75,000
Total			1,470,900

*Including cost of small dam.

CHAPTER 6

DRAINAGE

Generally speaking, it has always been assumed that the results of drainage are beneficial and that all properties affected by any drainage scheme are benefited in a greater or smaller degree. Throughout the period of settlement in Southern Ontario this was true to a certain extent as drainage enabled more land to be brought under cultivation, which meant more crops and greater prosperity to the community; also, in many instances, it enabled farmers to work the land earlier in the spring than they would have been able to do other-

INGERSOLL CHANNEL IMPROVEMENT

Aerial view of the improved channel through Ingersoll taken from the north-west. Bridge at centre of photograph is the Thames Street Bridge.

wise. All drainage legislation to date has been based on this assumption and has resulted in many drainage schemes being extended, not only beyond the bounds of economic feasibility, but even beyond the limits of physical practicability.

The result is that, in many cases, drains have been pushed into areas where they not only do not serve the purpose for which they were intended but actually are a detriment to the welfare of the community by draining water out of natural water-storage areas such as swamps and bogs without creating soil conditions dry enough for cultivation or even the maintenance of worth-while pasture.

This draining of swamps and bogs means that the water is not available to maintain adequate summer flow in the streams and has also lowered the water table to such a point that wells have gone dry as a direct result of draining. For example, farmers, whose properties border on the Ellice Swamp, were hauling water for cattle in the summer of 1948 for the first time in living memory.

Some drainage schemes are necessary and beneficial, others are ill-considered and unwise, therefore no drainage scheme should be undertaken without due consideration of all the physiographic and economic features which enter into the scheme.

At least 850 miles of drains have been constructed on the Upper Thames Watershed and at least $1,431,793 has been spent on the work. This figure does not give the whole story as records of the costs of the early drains were not available. In addition, many Municipal Drains were originally Award Ditches which have been converted to drains in recent years, so that the original cost of construction and maintenance in early years is not included.

The Authority should investigate any drainage scheme which is proposed within its boundaries, and have a representative present at the presentation of the engineer's report as provided by The Municipal Drainage Act, R.S.O. 1950, c. 246, s. 8 (13).

CHAPTER 7

COMMUNITY PONDS

An important phase of the conservation program in any watershed is to preserve existing ponds and if possible to supplement these with new ones wherever the topography is suitable and the cost is within the scope of the purposes to be served. Such additional ponds in some cases can be made by rebuilding small mill dams which have been abandoned; by repairing existing dams; and by building new ones on suitable sites.

With the above purposes in mind, an inventory was made under the heading of community ponds on the Thames Watershed, in which the following information was assembled:

First, the location and condition, present and possible future use of small natural lakes or ponds;

This dam and mill pond at Harrington, originally built for water power, is now being restored by the Authority for recreation purposes.

COMMUNITY PONDS

-LEGEND-

NATURAL PONDS (N) ▲

EXISTING PONDS (E) ●

POSSIBLE PONDS (P) ■

SCALE 0 1 2 3 4 5 MILES

Second, existing mill ponds which might be improved or used more extensively for community purposes;

Third, locations on streams where small ponds might be built by using old damsites or other places on small tributaries.

With the first two groups above, the report and the map which accompanies it gives the location and condition, and in some cases recommendations regarding these; but the third group must be considered as a suggested program which can be acted upon at the present and enlarged in the future when funds are available.

There are hundreds of suitable sites for small ponds on the tributaries of the Thames, but keeping in mind that this report is only intended as a start in this work, a limited number of sites have been chosen. The object in making the selection is to distribute a pond-building program over the whole area.

Ponds have been classified as natural ponds (N), existing mill ponds (E) and possible ponds (P), which include former damsites capable of reconstruction.

The accompanying map shows the location of these ponds by classes. Fifty-three pond sites have been mapped, of which 8 are natural ponds, 14 are existing mill ponds and 31 are possible ponds. The three classes are distributed throughout twenty townships in the watershed.

5

WILDLIFE

CHAPTER 1

INTRODUCTION

Land well adapted for wildlife should produce or harbour a permanent population of interesting and useful species and an annual crop of game and fur. A natural balance between the numbers of the various species should also be maintained. A hawk which preys on destructive meadow mice in an orchard may be worth many dollars to the farmer who protects it.

The traditional methods of wildlife management have included restrictions of the daily and seasonal kill and of the method of kill, predator control, reservations of game lands and artificial restocking. The provision of a proper habitat is often more important than all of these. In Southern Ontario, and in particular in the Thames Watershed, the amount of good habitat available appears to be the controlling factor in the abundance of most wildlife.

The fieldwork was concentrated on a few of the more significant problems. The watershed provides a great variety of wildlife habitat, and the streams vary widely in suitability for fish. A beginning has only recently been made in the basic research on game environments in Southern Ontario. The techniques of stream and lake survey are at present farther advanced. In the present survey the chief detailed work was therefore a study of the environment for fish. Of all other wildlife only one species was chosen for detailed attention. This species, the European hare, is potentially harmful to reforested areas and to orchards. It is also the most important game animal of Southern Ontario.

CHAPTER 2

FORMER SPECIES

At least ten species of mammals which formerly must have been found in the watershed no longer occur in it. These include the beaver, black bear, marten, fisher, wolverine, timber wolf, otter, bay lynx, Canada lynx and cougar.

The country probably supported a maximum of game and the larger forms of other wildlife a few years after it was first settled. The cutting, burning and grazing of most of the remaining forest and intensive hunting and trapping have since then greatly reduced the wildlife populations. A few open country species such as the red fox, skunk and cottontail have increased.

Of the many species of birds whose populations have been radically changed three are of particular interest. The passenger pigeon is now extinct, the wild turkey disappeared from the watershed about 1885, and the bobwhite quail is reduced to the point where only a few single birds have been seen in recent years.

CHAPTER 3

PRESENT SPECIES

There is a rapidly growing interest in natural history in Ontario. Both London and Woodstock have a long history of organized activities in this direction. Many people outside these cities are also interested. The report therefore includes lists of species which may be found on the watershed. Thirty-eight mammals now occur in the watershed, including three which have been introduced. The birds of the London area have been intensively studied for more than fifty years. The report includes a list of 256 species. Of all these species 80 are recorded as "Rare birds, including Accidental Records". The remaining 176 species are divided as follows:

Permanent Residents (Nesting and Wintering)	21 species
Summer Residents	91 species
Migrants (seen only in migration)	55 species
Winter Visitors	9 species

The report also includes a list of 15 amphibians and 14 reptiles known to occur in the watershed. The watershed is not now within the known range of any venomous snakes. It is unlikely that any rattlesnake would ever be found in the area. Neither copperheads nor water moccasins occur in Ontario at all, and the common watersnake is not venomous.

Single wing deflectors in a trout stream. These are log cribs 30 inches wide and 30 inches high. The logs are wired and stapled to posts. Log spreaders are placed at intervals along the structure. The interior space is filled with gravel and sand, and the top is well sodded to prevent surface erosion and to improve the appearance. The wings are installed at an angle of 35°-45° to the direction of the stream, with the terminal end down stream from the base.

Single wing deflector made of three logs fastened together and staked securely to the bottom. Opposite this deflector a log bank cover can be seen. This is now partly overgrown with sod and brush. A bar has already started to form below the deflector. This device has proved a very effective stream improvement.

CHAPTER 4

IMPROVING THE FARM FOR WILDLIFE

The elimination of grazing of woodlots would be the most useful single measure in improving the wildlife environment. For the greatest value to wildlife the forest plantations proposed should be of mixed softwood and hardwood species. Large blocks of coniferous forest are not of much value to wildlife except in their early stages. After about twelve years they are sterile as far as most forms of wildlife are concerned, except at their edges. Good forestry practices in the farm woodlots will improve them for wildlife. Good farming practices which make a more luxuriant vegetation benefit wildlife, and some conservation practices, such as strip-cropping and terracing, are of particular benefit. A few field boundary hedges will help to protect crops from wind and serve as travel lanes and cover for wildlife. The most efficient windbreaks will include both trees and shrubs, selected to provide a variety of fruits for food.

Most of the Thames Watershed is unsuitable for the Ring-Necked Pheasant. Even the more southerly part provides only marginal pheasant territory, owing to the heavy annual snowfall and the high incidence of sleet storms. Periodic winter killing of most or all of the population may therefore be expected. Extensive winter feeding must be carried out by those who wish to farm the species. Food patches of standing corn, buckwheat, soy beans and Japanese millet may be left close to good cover.

Unused fence corners may be made into havens for ground-nesting species by planting a few trees and shrubs and protecting them. Gullies which have been reforested for erosion control are also of great value to wildlife. Many farms have at least one low spot where it would be easy to make a pond. If possible, ponds for wildlife should be separate from those intended for fish or for cattle. The methods of providing cover and food plants in such ponds are described, and a list of suitable plants is included in the report.

CHAPTER 5

SPECIES OF SIGNIFICANCE TO AGRICULTURE OR FORESTRY

The two species of greatest importance to agriculture or forestry are the European hare and the meadow mouse.

1. THE EUROPEAN HARE

This open country species is the most important small game animal in the Province. Following its original introduction into Ontario near Brantford in 1912, the species has come to occupy almost all the agricultural sections of the Province. The species was well established in Middlesex County by 1920. Most of the farming country of the watershed is admirably suited to it. After the spectacular rise in the hare's population in the watershed a high population remained until the early 1940's when the species declined rapidly. Its population was found to be increasing again in 1948.

The Jackrabbit is a potential menace to orchards in winters of heavy snow when other food is scarce. It has also been known to damage forest plantations. Several repellent washes designed to be sprayed on the trunks and branches of

This tributary of the Avon was formerly an excellent trout stream. It has been ditched and straightened to the point where it is now too wide, too shallow and too straight, and lacks pools, logs, boulders or other cover. It remains a cold stream, and is well shaded in summer, but its productivity is limited.

This sector of the Avon River above Stratford now lacks both shade and protective cover such as boulders or roots in the water.

The Harrington stream, in Zorra West Township, still provides excellent conditions for speckled trout. There is a shortage of deep pools in this stream. If deflectors were installed so as to form a few deep pools, the stream could be expected to produce larger trout.

trees have been developed. None has so far been found to be the perfect solution. There is an urgent need for continued research to discover adequate practical repellents. Individual wire mesh guards at least three feet high will protect young trees except in very deep snow.

2. THE MEADOW MOUSE

There have been several local outbreaks of damage to orchards and to trees in plantations by the meadow mouse. A survey was made in 1950 of the relative abundance of meadow mice in many areas of land suitable for reforestation in the watershed. Local populations of the species tend to rise to great numbers and to fall rapidly again in a rather irregular manner so that the cycles cannot at present be predicted in advance in Ontario. The meadow mouse was found to be abundant in only 14 of 158 areas examined. Meadow mice were therefore comparatively scarce in this part of the Province in 1950.

The vulnerability of each of the fifteen areas recommended (in this report) for acquisition for reforestation was assessed. Of the 15 areas 4 were considered to be safe from meadow mouse damage. The remaining 11 were considered to be vulnerable and of these 5 were classed as very vulnerable. These are listed in the report. Many of the areas are more vulnerable than they appear, since the elimination of grazing after reforestation will allow long grass to develop on some of the slopes. Where this condition exists, and where the plantable land adjoins or includes patches of low land with dense grasses and sedges, high populations of meadow mice can be built up in the plantations.

Advice on methods of eliminating damage to trees by rodents is available from the Research Division of the Department of Lands and Forests. Protection of predators of the mouse (such as hawks, owls, and snakes), and protection of the trees, until they are eight to ten years old, with sprayable repellents will probably be the most effective safeguards. The mice can also be poisoned with baits treated with strychnine or zinc phosphide. More research is urgently needed on sprayable deterrents.

CHAPTER 6

FISH

1. METHODS

The Thames River was intensively examined and the various branches classified as to their present suitability for fish.

Collections were made at 291 "stations" on the river of both fish species and of many species of aquatic insects, which are excellent indicators of the river conditions for fish at the critical time of year. The condition of the stream at each station was noted. From these data maps were prepared showing the following characteristics of the river: dries up completely in summer; sections of cold permanent water suitable for speckled trout; sections suitable for bass species; polluted water and other characteristics.

This kettle pond, near Crystal Lake, in Nissouri East Township, is one of the few remaining ponds in the watershed where wild ducks nest undisturbed by man.

The pond at St. Marys provides small-mouthed bass fishing.

The south branch of the Thames near Dorchester has a fair population of small-mouth bass, but is occasionally polluted by materials entering the river at Woodstock and Ingersoll.

2. THE RIVER VALLEY

The watercourses vary from open ditches, which are merely the continuation of tile drains, to valleys with steep slopes and cool and rapid streams issuing from hillside springs. Between these extremes there are many intervening types. While the South Branch between London and Woodstock is sluggish and heavily silted, the North Branch below St. Marys has been more seriously affected by flashy floods and devastating ice action, and the bottom in many sectors consists of stones and boulders with little silt. The banks of the watercourses are, with few exceptions, pastured and livestock are commonly watered in the streams.

3. PERMANENCE OF FLOW

Only a few branches dry up in summer. These are chiefly in Hibbert, Usborne and Logan Townships. Most of the branches are small but permanent streams in summer. The South Branch provides more flow than the North. In a typical summer the North Branch is reduced to about 25 c.f.s. in its lower reaches and the South Branch to about 40 c.f.s. The permanent spring-fed tributaries in both branches come chiefly from springs in Nissouri East, Zorra West and Zorra East Townships.

4. TEMPERATURE CONDITIONS

The chief stream temperature characteristics affecting the distribution of fish were deduced from the presence or absence of "indicator species" of insects, and the results are mapped in detail in the report.

5. FISH DISTRIBUTION

The distribution of the major game fish species is shown in a map accompanying the report. The 42 species of fish taken in the river during the survey are listed. Small-mouth bass and rock bass were both well distributed through the watershed. Speckled trout were found at 11 stations only. Three species of sunfish were taken. The creek chub had the widest distribution of any fish species. The common sucker was found at nearly 200 stations. The pike-perch (pickerel) was not collected, although more than a million spawn of this species have been put into the river at various times. If still present it must certainly be an uncommon fish in the river.

A map accompanying the report shows the parts of the river which are seriously affected as a fish habitat by pollution. The present pollution of the Thames and the means to prevent it are discussed in the Water section of the report. While there is considerable industrial pollution, it is insignificant compared with the effects of effluents of many overloaded sewage plants.

6. DETAILED STUDIES: TROUT CREEK

Trout Creek was studied in greater detail than was possible for the remainder of the Upper Thames. This creek is some 25 miles long and includes in its 8 tributaries a great variety of stream types. Trout Creek has the best trout waters of the North Thames river system, but even here they are not extensive. The few streams remaining are all small, supporting a few fish of small size. There is considerable bank erosion and accumulation of silt in the lower parts.

Snake fences and weedy patches, such as this, are now uncommon in many parts of the watershed. They provide cover and food for the Bobwhite and Ring-necked Pheasant.

Clean fences are now considered by most farmers to be one of the hallmarks of good farming practice. They provide no cover for game. Substitutes such as wild life food and cover plots should therefore be included in planning for game management.

Three tributaries are listed which could be improved by the planting of alders or willows to shade the streams and keep them cool. Dams placed near the lower end of the best trout streams would increase the trout production and provide unobstructed angling. Specifications for construction of these dams are given in the report. To create pools in the main stream, low dams or deflectors of types illustrated in the report should be constructed.

7. IMPROVEMENTS FOR THE MAIN RIVER AND FLOOD CONTROL BASINS

The types of improvements described for Trout Creek could be applied to many other parts of the river. Good management of the soil and of the forest cover, and the planting of trees for shade above the streams, should result in a considerable increase in the range of the speckled trout in the watershed.

Where large impoundments, as recommended in the Water section of the report, are made, large-mouth bass and calico bass might be introduced, as these species are well adapted to warm and weedy ponds.

Where dams are constructed it is important that there should be no interruption of the flow during construction, to avoid elimination of the organisms on which fish feed.

6

RECREATION

CHAPTER 1

THE APPROACH TO THE PROBLEM

The planning of recreation facilities in Ontario has in the past been chiefly directed towards two ends: facilities such as parks and playgrounds within the boundaries of cities and towns, and facilities for long and comparatively expensive vacations in wilderness regions remote from the industrial and agricultural areas of the province. The growing concentration of the population in industrial areas has overtaxed the local facilities, while the time and cost involved in reaching wilderness areas have prevented the average family or group from visiting such areas more than once or twice a year.

It is now well recognized that a third type of facility has been neglected—the public area within a few miles of the agricultural or urban worker's home.

The old quarry at St. Marys has been acquired by the town. Facilities such as diving boards, a raft and a refreshment booth have made this a very popular swimming pool.

This attractive pool two miles north of Woodstock is in the middle of a farming district, and is used by many young people in the neighbourhood.

Dorchester mill pond which has been used for recreation for many years.

This lake and the park surrounding it at Stratford were planned forty-seven years ago at a time when other planners were allowing industrial development to mar the river banks.

Facilities provided in the park include both play areas for intensive use and restful scenes such as this.

This lake is much used for bathing. It also provides a home for Black Ducks and swans.

This lack of good recreation areas close to the city has been an obstacle to the enjoyment of healthy out-of-door activities and relaxation. This report has, therefore, two objectives: to make an inventory of the existing public recreation areas in the Thames Watershed; and to direct attention to the areas which are needed for public use, but which are threatened by private interests. Three points have been kept in mind:

(a) The retaining and protection of natural advantages;
(b) The development of adequate facilities in maximum variety, available to people of all ages, tastes and income groups;
(c) The adjustment of recreation plans to any other conservation measures proposed for the Thames and neighbouring watersheds.

The term "recreation" includes a wide variety of activities, for most of which there are suitable areas within the Thames Watershed. Some such areas have only to be acquired to be available; others require to be improved or protected.

Modern master plans for both large and small cities include a zone of land called a Green Belt surrounding the inner metropolitan area and intended to provide space for many kinds of outdoor activities. If the projected growth of the city of London would warrant a Green Belt in the future, the value of a long-range plan cannot be overestimated.

Of the 190,000 population of the watershed, 138,000 or 70 per cent live in three cities and three towns—London, Stratford, Woodstock, Ingersoll, St. Marys and Mitchell. More than 50 per cent of the watershed's population live within five miles of the centre of London. Even the rural population is denser in the southern part of the watershed. While the northern part of the watershed must not be neglected, the need for recreation facilities in the south-western part of the watershed is obviously greatest.

The Thames and its tributaries are heavily polluted at each of six population centres. Many of the smaller tributaries are also fouled by milk wastes. Fourteen of 24 cheese factories and creameries lacked efficient milk waste treatment at the time of the survey. Pollution of the Thames and the means to control it are discussed in detail in the Water section of the report.

CHAPTER 2

EXISTING FACILITIES

1. URBAN FACILITIES

The City of London owns 654 acres of parklands and playgrounds. It is regrettable that of this total 465 acres or 70 per cent lie well outside the city limits. Springbank Park is, however, a very useful asset to the city. It will be much more attractive when the present severe pollution of the river is checked.

Victoria Park at Stratford is the best example of completed land planning for recreation in the watershed. Stratford has ten parks and a fairground including 125 acres. Woodstock has four parks totalling 61 acres and a fairground. Southside Park includes facilities for canoeing, swimming, field sports,

An area recommended for acquisition as a public picnic site. This lies on the Thames River just east of the bridge south of Komoka. The site is on a good road about a mile from Provincial Highway No. 2.

This land, included in the area described above, would be used for car parking.

On No. 7 Highway, near St. Marys, this roadside picnic site has been set up by the Ontario Department of Highways. The neat arrangement of facilities is an indication to the public to keep the area clean and tidy.

picnics and camping. Ingersoll and St. Marys each have 21 acres of parks. St. Marys has already developed one of its two flooded quarries to form a fine natural swimming pool. Mitchell has recently developed a Community Centre of 22 acres with an excellent natural site and an exceptionally well designed swimming pool and bathhouse. When the work is completed the Community Centre may well be a model for other centres in South-western Ontario to follow.

2. RURAL FACILITIES

(a) BEACHES AND LAKES

Of 19 lakes and large ponds listed in the report, only two are in public ownership. The total lake and pond water in the watershed, apart from river courses, is only about ¾ of a square mile. Most of the privately owned lakes are posted against intruders.

(b) PICNIC SITES AND CAMPING AREAS

While there are still some excellent picnic sites along the river courses in the watershed, none are public property. Good picnic sites are becoming progressively rarer. Many of the best are now in the hands of private owners from nearby cities, who do not allow visitors. There are no camping areas outside the urban areas in the watershed.

(c) NATURE TRAILS AND ARBORETUMS

Nature trails are marked paths intended to help the average citizen to appreciate the interesting and attractive side of natural history. A beginning in this work has been made at Springbank Park, London, but nowhere else in the watershed.

(d) YOUTH HOSTELS

The Canadian Youth Hostels Association organizes well-supervised sleeping quarters in rural areas, open only to hikers and cyclists. There were at the time of the survey two Youth Hostels in the watershed, one near St. Marys and another at Woodstock.

(e) SCENIC DRIVES

The more attractive drives in the watershed are described in the report. Such drives should have occasional "pull-outs", where a car may be driven off the highway, but at present there are none available.

(f) HISTORIC SITES

Four tablets have been installed by the Historic Sites Commission of the National Parks Bureau. Three in London commemorate distinguished persons. The fourth, at Ingersoll, notes the establishment of the first cheese factory in Canada. None are of importance to rural recreation facilities. A few cairns and markers have been set up by local bodies. One commemorates the founding of Mitchell, another records the original Seebach family settlement, and a third, at Shakespeare, notes the beginnings of the village. With these exceptions there are no publicly owned historic sites in the rural parts of the watershed.

A view of the North Branch of the Thames River in the proposed extension of the Thames Valley Park. The flat lands at the top of the hill would be outside the park boundary.

The Green Heron, Spotted Sandpiper and other shore birds are common along this stretch of the North Branch of the Thames River in the proposed park. The preservation and wider spread of interesting species of animals should be a major objective in park management.

CHAPTER 3

RECOMMENDED FACILITIES

1. THAMES VALLEY PARK

The valley of the North Branch of the Thames between London and St. Marys is very attractive and easily accessible. It is therefore recommended that a park be established which would surround the flood storage area and might eventually stretch some 13 miles northward to No. 7 Highway at Prospect Hill. The maps accompanying the report show in detail the part of the valley which has already been planned as an Intensive Use Area by the Authority's Parks and Recreation Advisory Board, with the boundaries slightly modified to take maximum advantage of existing lot lines.

Existing woodlands, chiefly overgrazed, occupy 90 acres of the intensive use area and 320 acres in the northern section. Much of the remainder is stony pasture or unused land with patches of hawthorn trees. It is therefore not of much value for agriculture.

The following facilities could be made available in the park:

(a) SWIMMING AND BOATING FACILITIES

The permanent lake will cover 650 acres. It will be four miles long and up to half a mile wide. Some mud flats would be inevitable in the upper reaches of the lake, but excellent facilities for water sports would be available at various points.

(b) BEACHES AND WADING AREAS FOR CHILDREN

It would be necessary to make one or more artificial sand beaches.

(c) PARKWAYS

The upper stretches of the river valley lend themselves to attractive parkways. Parking places would be provided at those points on the drive which have exceptional views.

(d) PICNIC SITES

Both group and individual picnic sites should be developed, with cemented fireplaces, and here and there rough benches and tables.

(e) CAMPING SITES

There are several attractive camping sites along the river which could be easily developed, but the critical factor would be location of spring water.

(f) NATURE TRAILS

The extension of the park in Concessions II and III, Lots 27 to 30, in Nissouri West Township is an area in which a nature trail should be laid out.

Fanshawe Lake—a cove just above the dam.

(g) WINTER SPORTS

There are excellent opportunities for ski trails to be opened at both the north and south ends of the park.

(h) YOUTH HOSTELS

One or two more Youth Hostels might be established in the neighbourhood of Thorndale or Plover Mills.

(i) REFORESTATION

Part of the reforestation of bare areas in the park could be carried out under an educational program in which schools, Scout troops and other groups could plant small areas annually.

(j) PARK ADMINISTRATION

The preliminary plan prepared by the Parks and Recreation Advisory Board of the Authority already includes sites for administration and service buildings and an athletic field and trailer camp. Fees can be charged for many park services. In similar parks surrounding impoundments in the State of Ohio these services have been very successful and have provided enough profit to pay for some of the improvements. Where cabins or refreshment pavilions in modern parks are operated by concession rather than directly by the Authority, minimum standards should be set both for the design of the buildings and the operation of the services. The Authority should be responsible for the design and construction of the buildings.

Fanshawe Lake—a proposed woodland walk.

2. PICNIC GROUNDS AND SMALLER PICNIC SITES

A few additional smaller picnic sites should be acquired for the public near to other population centres in the watershed. Parking space, fireplaces, tables and benches, and refuse cans would be supplied where the site would be heavily used. Of several hundred possible sites examined, 22 of the best were selected and are mapped and listed in the full report.

3. SWIMMING HOLES

Diving boards and some indication of the depth of water could be provided at some of the more popular swimming holes along the river.

4. WILDERNESS AREAS

It is of interest to the general public and particularly to naturalists to retain in every region a small section of country as nearly as possible in its primeval conditions. Two areas which might be considered for this purpose are the woods surrounding Hodges' Pond in Concession IV, Lots 18-21, of Oxford Township, and the Huntingford Woods at Concession XI, Lot 15, in Zorra East Township.

5. HISTORIC SITES

The site of the old mill at Byron, in Westminster Township, might eventually be acquired for the public. The original wooden mill-wheel is still in existence, and the setting is very attractive.

The sites of the earliest mills in the watershed are known, but no parts of the structures remain.

Public interest in the old canoe routes and trails established by the Indians has always been keen. A cairn or marker could be set up close to the end of

Simplicity of design should be the keynote in all structures or facilities in a modern rural park.

A lookout which is merely a natural vantage point of no great elevation offers a view and rail for the protection of the observer.

These stone steps blend easily with their surroundings.

A wooden foot bridge, to be sturdy and safe, need not be elaborate.

the Indian trail from the head of Lake Ontario to the Thames River. The actual trail end was at a point on Cedar Creek near Woodstock.

6. CONSERVATION TRAIL

Good examples of sound conservation methods in actual use in fields, woodlots and streams are worth more as conservation education than all that can be written on the subject. Many tours have already been organized in various watersheds to show such examples to the public. These have been very successful. It is therefore recommended that the Authority should stimulate tours of this kind in the Thames Watershed by establishing a Conservation Trail. Permanent markers can be set up alongside examples of good land use. Those marking misuse of land would be set up only if the farm is abandoned. An outline and map of the tour could be mimeographed for distribution to all students or visitors taking part in it. The route should include several attractive picnic sites so that parties from widely separated schools could cut in on the route at several points and still have suitable areas for lunch.

MAPS

The following large maps are included in the full report and a limited number are available on request:

Recommended Land Use. Map 35 x 43½ inches, in two sections, scale one mile to ¾ inch. Nine colours.

Natural Water Storage Areas—Reforestation Land—Existing Woodland. Map 43¼ x 56 inches, in four sections, scale one mile to one inch. Three colours.

Biological Conditions of Streams. Map 26¼ x 19 inches, in two sections, scale three miles to 1¼ inches. Five colours.

Thames Valley Park. Map 51½ x 13½ inches, in three sections, scale 1,000 feet to $^{11}/_{16}$ inch Five colours.

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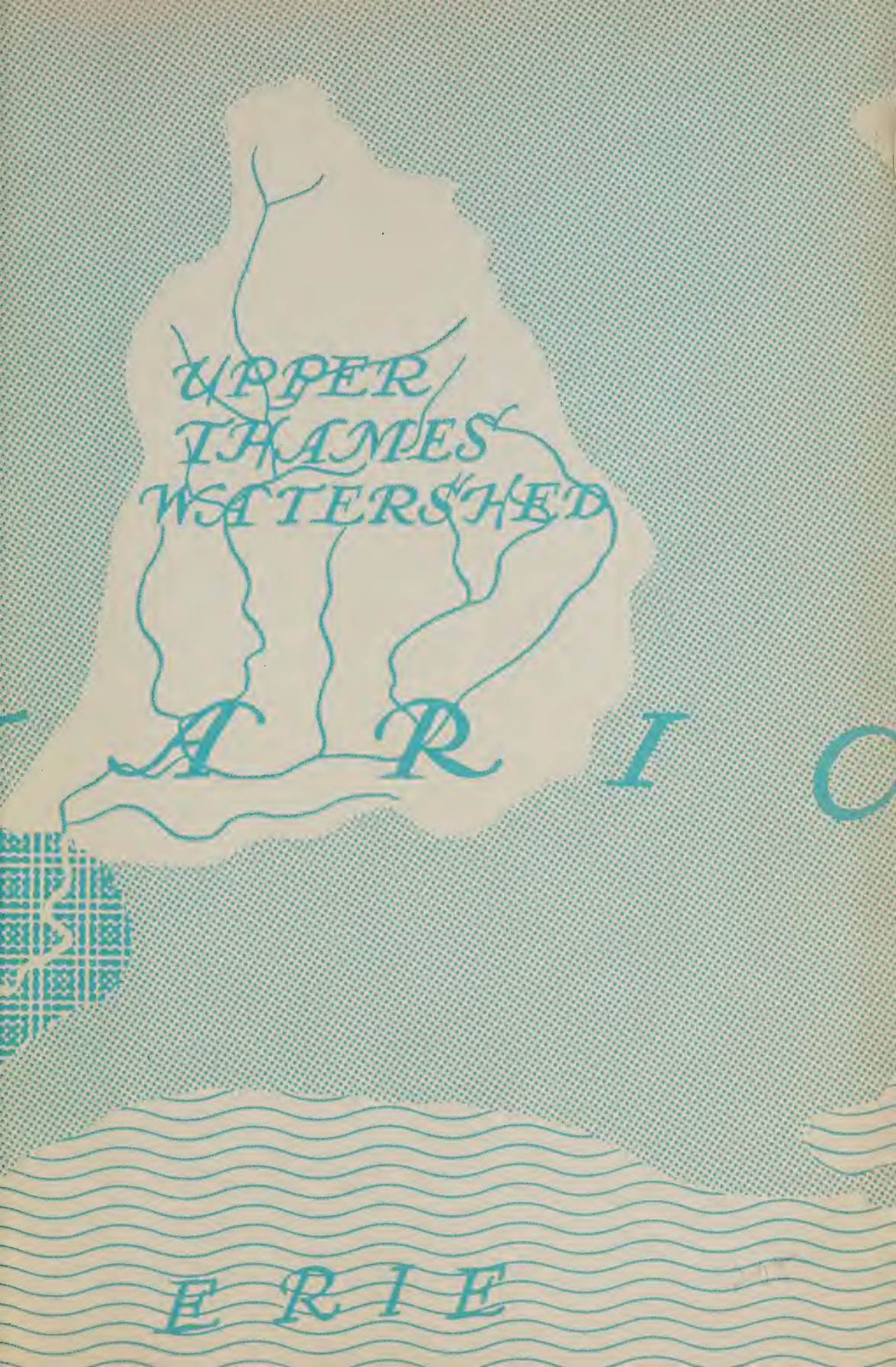
UPPER
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"River Valley Development is the wise use of all the natural resources of a river valley for all the people living in the valley, for all time."

- Samuel Woodstock